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I have endeavoured to apply, concisely, Liebigs' theories, which are principally founded on well-known facts, and posessing, as they do, the evidence of simplicity in a high degree, they are most probably true.

I have, therefore, unhesitatingly and freely availed myself of his talented works, as connected with oxygen and galvanism together with the works of Sir Humphrey Davy, Drs. Christison, Prout, Graves, Beddoes, M. Froreip, M. Duclo, Professor Orioli, and many other respected names noticed in the work, with the view to illustrate the application of chemical theories in producing a healthy change in diseases of the principal organs of the body, by the direct local application of remedies to the blood and nerves, as by the inhalation of factitious vital air, nitrous oxyde, and other gases, and the application of galvanism and electricity.

On referring to the list of diseases for which the above remedies are successfully employed, it must strike a non-professional person, as very extraordinary, why such valuable means have been neglected, since they can be applied with little trouble and expense, and require for their preparation and application not much practice, but rather care and patience.

Possibly the diseases for which I have recommended the uses of the gases and galvanism, may at first appear of too diversified a character, but when it is considered that most of the distinguished medical authorities view the diseases of which I have treated as mainly dependant upon the same cause, namely, a disordered state of the blood and nerves, sound induction would lead to the conclusion that they must all be curable upon the same principles, that is, by restoring the normal condition of the blood and nerves, so that a healthy action in the nervous system (local general) and the removal of diseases may follow.

I have, in my practice, found this principle amply illustrated; and, if it were more generally adopted, medical science would be simplified, and the community at large proportionately benefited. Unfortunately there is a general opinion that the cause and nature of affections of the nervous system are obscure, particularly the diseases of those nerves and ganglions supplying the respiratory and digestive organs, and the muscular system.

This latter circumstance has given rise to a variety of conflicting testimonies, and, as a natural consequence, various plans of treatment, if not an empirical practice, have been introduced.

Since the commencement of my professional career, in 1819, I have particularly directed my attention to the economy of the Spinal Nerves. In 1827 I commenced to lecture on the Principles and Practice of Surgery which I delivered daily for twelve years. In each course I included, as much as time would permit, the important subjects of irritation of the Nerves of the Spinal Column, and Distortions of it, and of the Chest and Limbs. Finding that my time was perfectly inadequate to the teaching of my pupils, the nature and treatment of these affections in a manner commensurate with their vast importance, I commenced, in 1830, a separate course on these subjects; and in 1835, I published my "INTRODUCTORY LECTURES to the Course," and in 1842, I published my '*Treatise on Irritation of the Spinal Nerves, as the source of*

Nervousness, Indigestion, Functional and Organical Derangements of the Principal Organs of the Body, &c."

These circumstances led me into an extensive field, whence I could gather practical information upon various forms of distortions, irritation of the spinal nerves, and their ganglions, producing paralysis, and derangement of the different organs of the trunk.

Organs become sympathetically affected though remote from the source of the disease in the nervous centres, the brain, and the spinal marrow, and in the ganglionic system; hence we have the various diseases some of which are treated in this work.

Most of the patients who were induced to consult me through my late work, had their maladies in the chronic form, having consulted, in many instances some of the most eminent practitioners of the day; and, consequently, I found, it would be more than useless to pursue the ordinary mode of treatment. I, therefore, had recourse to untried means, for which however I claim nothing beyond a wish to promote and extend the use of the invaluable agents which I have employed.

I anticipate that objections may be raised to some of the positions I have ventured to maintain; but being satisfied of the efficacy of the mode of treatment which emanates from these principles, I feel justified in giving them publicity, and in earnestly entreating my medical brethren, if not to adopt my views in their full extent, to yield, at least, a fair and impartial trial to the practice.

In that case, with mature, and practical jugment, I shall not despair that the result will testify, that the principles are grounded upon broad and scientific bases, and that the mode of practice will prove no less rich in further discovery than it is at present neglected and uninvestigated by the great body of the medical profession.

If these humble labors shall in any way tend to induce medical practitioners to direct their attention, and apply in their practice, gases and galvanism as remedies to alleviate the suffering and prolong the life of their fellow creatures, it will afford much satisfaction to

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ON THE REMEDIAL INFLUENCE OF GASES, ELECTRICITY, &c.

CHAPTER I.

PRELIMINARY REMARKS.

In this little work it is not my intention to speculate about the precise seat and nature of diseases, nor their terminations, but merely to state the experience of more than a quarter of a century the result of experiments with various remedial agents, that have been either partially or totally neglected by medical practitioners, in consequence, I conceive, of the inconvenience of their application, or of the time necessarily consumed in their administration. Most of the remedies upon which I have been experimenting have been but very partially adopted in the medical profession, with the exception of electricity and galvanism; and these, until within the last year or two, have incurred a disreputable character, in consequence of their having been indiscriminately used and vaunted for the cure of every disease to which flesh is heir to, as a means of livelihood to non-medical practitioners, rather than for the want of remedial qualities in appropriate cases.

The treatment of diseases now, as ever, must be guided by the experience of means suggested by contemporary practitioners, and the accumulated evidence of prior ages, improved by the aid of a progressive knowledge in the collateral sciences; and by carefully watching and noting the effect of remedies. This mode of proceeding is necessarily the only legitimate way of improving our knowledge of therapeutics, since the mere knowledge of the nature of disease can never suggest appropriate remedies.

Medical practitioners in all ages, have agreed that many valuable curative means, both in principle and application, are continually developed by accident to the acumen of the intelligent physician, and seized upon for the advantage of his future practice, and which no depth of thought or power of reasoning could have reached; but, alas, for the want of the habit of recording the treatment which is capable of curing any affection, or of views throwing light on the application of remedies, or the nature of disease, his experience is allowed to fade from his memory, or lost in the obscurity of time. I have, therefore, resolved to publish the following facts, which chiefly refer to the effects of inhalation of gases, and use of galvanism in certain abnormal conditions of the human frame.

My practical experience of the advantages of inhalation of gases, and the use of electricity, galvanism, friction, &c., in various functional derangements of the principal organs of the body, was greatly facilitated by reading Professor Liebig's works on Agriculture and Organic Chemistry, all his views in which profound works I have availed myself of, in order to illustrate the therapeutical powers of gases and galvanism.

The successful application of these neglected remedial means, have in many instances far exceeded my most sanguine expectations, particularly in diseases of the lungs, liver, stomach, and in paralytic affections.

Since the normal action of all organs, the nervous system included,—must depend upon the healthy condition of the blood; and the pure state of the latter can only exist after it is thoroughly oxidized in the lungs, thus prepared to give vitality, and to supply all waste produced by the action of the organs, and at the same time to enable the excreting organs to throw off all matter that is no longer of use, and would prove injurious if retained, it is evident that the oxygenation of the blood is a vital act of the greatest importance.

The following is the theory of the chemical phenomena of respiration:—the oxygen of the air is absorbed in the act of breathing by the arterial blood in the lungs, and is from thence carried to the circulation. In its passage, and by means of capillary tubes, a certain quantity combines partly with carbon, to form carbonic acid, which remains in solution in the blood, and partly with hydrogen to form water. The blood thus charged with carbonic acid, and by this means transformed into venous blood, arrives in the lungs, where it abandons to the air its carbonic acid, and again takes up oxygen, and is transformed into arterial blood, to recommence a new evolution.

An interruption of the chemical phenomena of respiration will produce disease in some organ that is either most seriously injured by this occurrence or otherwise most predisposed to fall into disease. From such a primary cause of disease, I have often seen ailments of the body existing to so great an extent as to preclude any reasonable expectation of recovery; yet, I have thought it my duty to make the attempt. Notwithstanding that at first I despaired of success, I have had the great satisfaction of obtaining it by perseverance. It must not be imagined that I have less confidence in the importance of inhalation, electricity, galvanism, friction, &c., because my professional brethren either pay no attention to the administration of them, or make trial of them in a slight, and I must say inadequate manner; or because they report lightly of the trial, or probably pass sentence of condemnation. With a weaker confidence in the merits of the different means of medical treatment, I should have had less zeal to pursue them, and could not have sufficiently encouraged my patients, to obtain the results which have happily justified those means.

A general scepticism prevails as to the curing of tubercular phthisis, scrofula, asthma, chronic bronchial affections, paralysis, nervousness, and some forms of cutaneous affections; in truth, there are no diseases which bid such general defiance to the means of medical art. Some members of the medical profession, however, doubt even the possibility of success in some of these cases; but to them, and all, I can most conscientiously declare that all my cases are related with the strictest fidelity, and that I have, in every instance, studied rather to under-rate the results than the contrary. In the selection of cases from authors, I have had the same anxiety for the truth, by selecting cases from works only of the highest reputation; for that which has only the semblance of truth will, meteor-like, pass away, but truth itself must ever remain firm and unshaken.

Doubtless, some cases are incurable, but in the most desperate circumstances, I can assert that more or less relief may be afforded by some of the means to which I have referred; and it is surely right to give every invalid the chance of receiving benefit, rather than leaving him to his fate, or sending him to another climate, only to find a foreign grave.

Whatever may be the *a priori* opinions with regard to these remedies, I may state, that in no instance have they, in the various diseases in which I have employed them, proved injurious; nevertheless, my confidence in, and recommendation of these old remedies, may be totally disregarded by the sceptical portion of the public, and may possibly disappoint that portion who more readily confide in that which is new, than in that which is true. Scepticism and credulity are twin monsters, who equally oppose the ever simple and smooth course of experience on the current of truth. Pretenders there are to refined originality, and disseminators, with electric speed and brilliancy, of spurious medical philosophy; such, for instance, as the modern practitioners of hydropathy, homœopathy, and mesmerism; that inculcate practice by commission in the former and omission in the latter, who may be said to be—

> " Our nation's terror, and her bloody scourge."

In Liebig's Lectures, published in the "*Lancet*," vol. I. p. 436, (1844), the following trite observations appear respecting these ephemeral practitioners:—"The existence of hydropathic institutions—those dens of covetous and rapacious gamblers,—where the wretched invalid resorts to throw the dice for health and life; the rise and progress of the homœopathic system, which treats truth with scorn, and bids defiance to common sense, loudly proclaim the need which exists for the adoption of settled principles, definite methods of research, and a systematic arrangement, to guarantee their attainment and retention."

It is true, that this grand object has not been as yet entirely attained, although sought for by the laborious researches of the most sagacious and best experienced men for a thousand years, and doubtless medicine and physiology are, like other sciences, in a continual state of progress; enormous labours, the expenditure of incalculable energies, have elevated these sciences to that high degree of development which they have obtained, and to the exalted ground they now occupy.

Practitioners who adopt the theoretical follies of Hahnemann, Priessnitz, and animal magnetisers, do so to obtain a living, not having the talent or patience to obtain the public confidence in the legitimate manner, consequently they cannot be considered a loss to medical science, still they injure in the eyes of the public, the common stock, the character in the medical profession.

I fear, however, that it must be confessed, that the cause of many invalids seeking health from new-fangled systems, at home and abroad, has arisen from the want of success attending the old practice, arising from the too generally contracted opinion, that diseases originate either in the stomach, liver, or the brain, and that the remedial means consist in administering mercury, purgatives, starving diet, and employing bleeding and cupping, and afterwards some preparation of iron, with or without bitters, and walking exercise; without sufficiently regarding other sources of disease, particularly the constitutional predisposition to certain diseases. Each disease requires to be treated according to the peculiar temperament of the patient, and with particular regard to the degree in which the spinal nerves are primarily or secondarily affected.

The following observations, which I have taken from Dr. Graves' talented work on clinical medicine, will be found to confirm my own published views on the attention that ought to be paid to "Irritation of the Spinal Nerves,"* The Doctor directs his reader's attention to what he calls "gouty ramollissement of the spinal cord." He states, that "in certain cases, where gout attacks the nerves, giving rise to gouty congestion or inflammation, and frequently recurring and acquiring increased strength, and deeper root as it proceeds, the morbid affection may after years, or even months, run on until it reaches the spinal cord, involving a certain portion or portions of that organ, and producing a loss of sensation and motion commensurate to the amount of spinal derangement. This is no uncommon occurrence; it is merely an instance of disease originating in the periphery of the nervous system, passing along the trunk of the affected nerve with a retrograde motion, and finally reaching the central parts, and then giving rise to various forms of paralysis."

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* RIADORE on "Irritation of the Spinal Nerves as the source of Nervousness; Functional and Organic Derangements of the principal Organs of the Body, and on the Temperaments and Habits of Man."

Dr. Graves has frequently in his writings proved, that disease commencing in the nerves of some particular part or organ, may be gradually propagated to the spine, and thus produce all the symptoms which are referrible to an original affection of the nervous centres. In various parts of his Clinical Lectures, he has brought forward numerous facts in proof of the propagation of disease from the circumference to the centre of the nervous system. He has mentioned a case of enteritis, arising suddenly from indigestion and obstruction, caused by an error in diet, which was followed by paraplegia. He has treated cases of paraplegia occasioned by stricture, which were relieved by curing the stricture; he has also seen cases of acute and chronic affections of the uterus and kidneys, which have entailed on the patients (as a remote consequence of the original disease), loss of the power of motion in the lower extremities, sometimes partial and curable, sometimes irremediable and complete. He has, in a word, seen cases which warrant him in concluding that gouty inflammation of the nerves and their neurilema, may, in process of time, extend to the spinal marrow, and its investments, and give rise to derangements of the latter, terminating in ramollissement and structural degeneration.

When paraplegia originates in disease of the spinal cord itself, the retention of the urine, and an irritability of the bladder, often announce the approach of the disease, long before the loss of power in the limbs becomes evident; whereas, in all those cases in which the paralysis creeps from the extremities along the nerves towards the spinal marrow, the bladder is affected only at a late period of the disease. It is obviously of great importance that practitioners should be more aware of this termination, as a knowledge of the fact may lead them to the timely adoption of preventive measures. Dr. Graves also observes, that gout may, without first attacking the nerves of the extremities, attack the spinal marrow and its investing membranes in the first instance, or in consequence of metastasis.

There can be no doubt that the above source of disease, and the importance of treating it according to the temperaments of the patients have been too generally neglected. In my late work, I have endeavoured to point out the different effects of remedies and diet upon different temperaments, and the mode of obtaining their beneficial effects, with, I trust, some degree of success; I hope, also, the present attempt will merit the same favorable reception from my professional brethren and the public, with which that work was met, and for which I shall ever feel most grateful.

The medical aids that I now commend, claim in their principles neither the charm of novelty, nor the praise of invention; yet, I flatter myself, that an opportunity has been afforded me of making great improvements with the means used, and in the mode of applying them; a task, perhaps the more onerous, as these means were never much used, and have consequently been little understood.

Since from the bountiful field of nature remedies may be culled for ages to come, that never have been tried: it may be asked why I have not struck out into some new or unknown field of research? My answer must be, that since remedies can only be found for their appropriate cases through experiment or accident, it consequently falls to the lot but of very few men to discover them. I have, therefore, preferred paying attention to neglected remedies, for remedies whilst new often lose the confidence of the medical practitioner from being too indiscriminately used, and also from a conviction that we have remedies numerous and efficient enough, if they were but aptly used. Thus we may hope to secure a greater success from medical practice, and to remove that unsettled condition of the public mind, and disposition to try new systems, and recover those strayed patients who have unwittingly confided in the impious modern systems, of which it may be said, that they were conceived in selfishnes and have been brought forth in murder.

To ward off and frustrate the wily nostrummongers and concocters of pretended superior systems of therapeutics, is a duty devolving upon every medical practitioner. The public is much interested in that character of the medical profession which is obtained by a high tone of preliminary education, and the acquirements exacted from candidates for admission into the colleges. These are guarantees of industrious habits in cultivating the science of medicine as well as the demeanour of a gentleman. Whilst the medical profession is constituted of such members, it can never fail both to deserve and obtain the confidence and the respect of the public, and be regarded as the only bulwark against the artful chicanery of the neoteric practitioner.

Our government, however, does not attempt to prevent either the constitutional or pecuniary injury daily committed upon the people by quackery, but rather encourages it, for the paltry, but iniquitous income arising from the sale of stamps. Thus a quack is a pecuniary caterer to the Right Honorable Chancellor of the Exchequer, and fully privileged to cheat the public and ruin their health; indeed, to do anything short of murder. Should death take place even after a long interval, no notice is taken of the affair; but if quickly following the taking of quack medicines the law will take cognizance, and if the jury should, perchance, give in their verdict as *guilty*, the judge will benignly award the culprit caterer a few months imprisonment, without stopping the sale of his nostrum, or even hindering his nefarious practice by a temporary suspension. Although quackery in medicine, infinitely more than in any other art tends to retard its onward progress, acting as a perpetual and effectual drag on the wheels of the chariot of science. Doubtless its commonness must be attributed to the impunity with which the constitution may be trifled with, and the natural tendency of the system to recover its equilibrium.

England is the only country in Europe which does not prohibit quackery in every form. The French have just refused to allow even medical men to introduce into Paris hydropathic practice. It is however, true, that our own College of Physicians have lately certified that an homœopathic practitioner was not a fit and proper person to have the medical charge of patients of an union, and consequently he was removed, in order that the practice which experience shews does most good might be obtained by the poor, whilst that plan which does least good is left to the rich.

Neither the College of Physicians or Surgeons, nor even our government, has legal power to restrict a medical or non-medical man from practising homœopathy, or any other system in private practice, nor in any way to prevent him from administering his nostrums to the public, so long as he does not disable or murder his dupes. Hence it behoves every medical practitioner to uphold the dignity and utility of his profession; by industry and perseverence exert himself to improve the therapeutic science, and maintain its rank in the respect and confidence of the public. Let me conclude in the words of the illustrious Beddoes. by hoping that we may see "that art, which can rest firmly on no other foundation than a just theory of the functions of the body, rising at length to a beautiful and solid structure. Nor, however remote medicine may be at present from such perfection, do we see any reason to doubt that, by taking advantage of various and continued accessions as they accrue to science, the same power may be acquired over the living, as at present is exercised over some inanimate bodies; and that not only the cure and prevention of diseases, but the art of securing and protracting the fairest season of life, and rendering health more vigorous, will one day half realize some of the dreams of alchemy."

CHAPTER II.

ON FOOD, ETC.

We shall now take a general view of the constituents of blood obtained from food and air, according to the best modern authority, and in doing this I shall avail myself extensively of the labours of Professor Liebig.

The blood contains nearly 17 per cent. of nitrogen; and from numerous analyzations, it appears (according to that profound chemist), that no part of an organ contains less than 17 per cent. of nitrogen; and no living animal, or any part of it which possesses shape, motion, and life, is destitute of nitrogen. Carbon and nitrogen are not formed by the living body, since it presents no elementary body without the administration of substances containing it. No nitrogen is absorbed from the atmosphere in the vital process, consequently it must be obtained from animal and vegetable food; in short, no nitrogenized compound, the composition of which differs from that of fibrine, albumen, and caseine, is capable of supporting the vital process in animals. Therefore, to continue life and organization of an animal, its blood must be imbued with everything necessary to continue the form and function of every organ of the animal.

It is ascertained that the nitrogenized constituents of vegetable food have a composition identical with that of the constituents of the blood. Liebig has divided the food of man into two classes, "nitrogenized and non-nitrogenized;" the former is capable of conversion into blood, the latter is incapable of this transformation. From those substances which are adapted to the formation of blood are formed all the organized tissues. The other class of substances, in the normal state of health, serve to support the process of respiration. The former may be called the *plastic elements of nutrition;* the latter, *elements of respiration.* The following, Liebig considers to be the plastic elements:—

"Vegetable fibrine,
Vegetable albumen,
Vegetable caseine,
Animal flesh,

Animal blood ;

and the following, the elements of respiration :

Fat,
Starch,
Gum,
Cane Sugar,
Grape Sugar,
Sugar of Milk.
Pectine,
Bassorine,
Wine,
Beer,
Spirits,

Man, when confined to animal food, respires, like the carnivora, at the expence of the matter produced by the metamorphosis of organized tissues ; and just as the lion, tiger, and hyæna, in the cages of a menagerie, are compelled to accelerate the waste of the organized tissues by incessant motion, in order to furnish the matter necessary for respiration ; so, the savage, living on animal food, for the very same object, is forced to make the most laborious exertions, and go through a vast amount of muscular exercise. He is compelled to consume force merely in order to supply matter for respiration, by wasting his tissues for the purpose, because it is the carbon of the flesh and of the blood of the animal, which must supply the place of carbonaceous food, a source limited in its supply, compared to what is contained in the food mentioned under the head of respiratory elements." Hence the cause of the enormous quantity of animal food consumed by savages, to supply a requisite quantity of carbon for respiration, in order to save his strength and life from the action of the oxygen which he respires, and which otherwise would soon waste and kill him, for want of the true source of animal heat engendered in the lungs and the body by the combustion, or the union of the oxygen he breathes, with the carbon contained in the ordinary forms of vegetable food.

Grain and other nutritious vegetables, yield us, not only in the starch, sugar, and gum, the carbon of which protects our organs from the action of oxygen, and produces in the organism the heat which is essential to life, but also, they contain in the form of vegetable fibrine, albumen, and caseine, the elements of that blood, from which all the other parts of our body are developed.

It is easy to see, from these considerations, how close the connection is between agriculture and the multiplication of the human species. The cultivation of our crops has ultimately no other object than the production of a maximum of those substances which are adapted for assimulation and respiration, in the smallest possible space. Science teaches us the simplest means of obtaining the greatest effect with the smallest expenditure of power, and with given means to produce a maximum of force. Liebig thus forcibly and simply points out the truth of the above theory: "Fifteen pounds of flesh contain no more carbon than four pounds of starch, and while the savage with an animal of the same weight, and an equal weight of starch, could maintain life and health for a number of days, he would be compelled, if confined to flesh alone, in order to produce the carbon necessary for respiration, during the same time, to consume five such animals." Hence, he observes, that a nation of hunters, on a limited space, is utterly incapable of increasing its numbers beyond a certain point, which is soon attained. The carbon necessary for respiration must be obtained from the animals, of which only a limited number can live on the space supposed. These animals collect from plants the constituents of their organs and of their blood, and yield them, in turn to the savages who live by the chase alone. They, again receive this food unaccompanied by those compounds, destitute of nitrogen, which, during the life of the animals served to support the respiratory process.

The equilibrium betwixt waste and power, or condition of health, is maintained in man and in animals, upon the same principles in all climes, but differs materially in the means according to clime and the nature of their food. All substances which constitute the food of man, must be divided as pointed out, into two classes, one for the nutrition and reproduction of the animal body, the other for its protection from the action of the oxygen during respiration. Thus starch, gum, sugar, beer, wine, spirits, &c., furnish no element capable of entering into the composition of blood, muscular fibre, or any part which is the seat of the vital powers. An adult man, well fed, neither increases or diminishes in weight in twenty-four hours, although the weight of his food and oxygen absorbed into his system, in that period, is very considerable; the reason is, that no part of the oxygen remains in the body, but it is given out again, combined with carbon and hydrogen, in the form of carbonic acid and vapour of water. At every expiration, and every moment of life, a certain amount of its elements are separated from the animal organism, having entered into combination with the oxygen of the atmosphere.

In order to obtain a basis for an approximate calculation, we may assume, with Lavoisier and

Seguin, that an adult man absorbs into his system 31½ ounces of oxygen daily; and further, that the weight of the whole mass of his blood is 24 pounds, of which 80 per cent. is water. Now from the known composition of the blood, we know that in order to convert its whole amount of carbon and hydrogen into carbonic acid and water 64·102 grains of oxygen are required. This quantity will be taken into the system in four days and five hours. Whether the oxygen enters into combination directly with the elements of the blood, or with the carbon and hydrogen of other parts of the body, it follows inevitably—the weight of the body remaining unchanged, and in a normal condition—that as much of these elements as will suffice to supply 24 pounds of blood, must be taken into the system in four days and five hours; and this necessary amount is furnished by the food, "which is always in a direct ratio with the quantity of oxygen taken into the system." Hence the food will be in proportion to the number and force of the respirations.

"A child breathes quicker than an adult, and consequently, requires food more frequently, and proportionally in larger quantity, than man, and bears hunger less easily. The number of respirations are fewer in a state of rest than during labour or exercise; the quantity of food necessary in both cases must be in the same ratio. An excess of food, a want of a due amount of respired oxygen, or of exercise, as also great exercise (which obliges us to take an increased supply of food), together with weak organs of digestion, are incompatible with health." I state this upon the authority of Liebig, and hence, I have recommended to the lame, the studious, the sedentary, and the idler, the inhalation of oxygen gas with the best results; also to those persons who keep themselves in very warm rooms, because the quantity of oxygen, under such circumstances in the respired air, is much less than in the open air, or in cool, well ventilated rooms. The volume of air which enters the chest may be uniform, in both close and open situations, but its weight, and consequently the amount of oxygen it contains, is not constant, because the air is expanded by heat and contracted by cold, and therefore the oxygen is in amount unequal.

In summer, atmospheric air contains water in the form of vapour, of which it is nearly deprived in winter. The volume of oxygen in the same volume of air is smaller in summer than in winter, and hence, diseases of the liver in warm climates. Persons who drink much wine and spirits, or are very sedentary in their habits, have indigestion, and become nervous and hypochondrical. Doubtless these diseases are engendered in consequence of the carbon not being taken up sufficiently by the oxygen, or not thrown off by the excreting organs. It must be obvious then, why I have met with so much success in practice in such cases by the administration of oxygen. Indeed, cutaneous diseases are often engendered by the same cause, and cured by the same means, after all the usual remedies have proved futile.

Friction over the body, and exercise of the upper and the lower extremities, even whilst laying down, or in bed, I have found a most important remedial means in dyspeptic and nervous cases. These nervous affections are doubtless more common now than formerly, because houses and rooms are built much warmer than in the time of our forefathers, and our food is more varied, nutritious, and tempting to the appetite; hence we have diseases arising from an undue quantity of carbon in our systems: thus both the higher classes of society, and operatives who work in crowded, warm, and ill-ventilated rooms, are afflicted with some-what similar diseases. As we inspire more oxygen at a low than at a high temperature, and require more or less carbon in our food in the same proportion; the consequence is, that more carbonaceous food is required in a cold than in a warm climate or residence. Hence, the naked Samoyedes, in their cold clime, are able with ease to consume ten pounds of flesh, and wash it down with copious draughts of train-oil or pure brandy, without bad effects, because the carbon and hydrogen of these substances only suffice to keep up the equilibrium between the external temperature and that of their bodies. It is on this account that the infinite wisdom of our Creator has ordained, that the food of the inhabitants of the southern climes should contain in its fresh state not more than 12 per cent. of carbon, whilst that of the inhabitants of polar regions contains from 66 to 80 per cent. in order to provide for the effect of a condensed atmosphere, and a consequent increase of oxygen.

From this cause, Liebig observes, it is comparatively easy to be temperate in warm climates, or to bear hunger for a long time under the equator; but cold and hunger united, very soon produce exhaustion. "All animals sustain hunger ill or well according to the number of times they respire per minute. For instance, a child breathes much oftener than an adult, and requires food oftener, and his temperature is 102°, whilst that of a man is 98 or 99·5°. A bird deprived of food, dies on the third day, while a serpent, confined under a bell respires so slowly, that the quantity of carbonic acid generated in an hour can scarcely be observed, and it will live three months or longer without food."

The oxygen of the atmosphere received into the blood in the lungs, and circulated throughout every part of the animal body, acting upon the elements of food, is the source of animal heat, without which the heat of life could not be sustained. Again, if carbon is not supplied in sufficient quantity in the food, the oxygen will destroy the individual in the same manner as it destroys animal matter, by putrefaction; whilst, on the other hand, an undue supply of carbon without a sufficiency of oxygen to consume it, or convert it into carbonic acid, to be thrown off by the lungs and excretory glands, will cause death by obesity and an obstruction to the organs on which life depends.

We see in the action of these laws the balance constantly maintained between health and disease; we also see the vast influence of that most active and potent of elements, oxygen gas, a due supply of which is necessary to the growth, health, and existence of every organic structure that occupies the surface of the globe.

OF CALORIC.

Heat is an important agent both in the functions of health, and the derangements of disease. In the very talented work of Dr. Metcalfe, of Pensylvania, on Caloric, its mechanical, chemical, and vital agencies in the phenomena of nature, it is demonstrated that caloric is the prime mover in the universe as the agent of God's fiat, to convert alike into vapour, and to move in space the drop of dew, to roll the planets in their orbits, millions and billions of miles, from the source of recipients of life, and conscious enjoyment from His hand; Dr. Metcalfe, has solved the problem whether caloric be a subtile and active essence, as hitherto supposed to be, or a mere motion or vibration among the particles of ponderable matter. Dr. M. says, "if caloric was a mere property or quality, how could it be taken from one body and added to another? And, if it augment the volume of other bodies, must it not itself have volume, occupy space, and, therefore, be material. It is also measured with mathematical precision by the thermometer, or by the expansion of bodies it enters, and by their contraction from its abstraction. Thus it modifies to infinity the forms, properties, and states of all other bodies. It passes through perfect vacuum and all matter, and exerts mechanical and chemical forces that seem irresistable—as in the eruption of volcanos, and even heaving of continents, the explosion of fulminating powder, &c.; in short, caloric is no less the cause of cohesion and chemical affinity than of repulsion and expansion.

It affects the nervous system in a perfectly determinate way: grateful in moderation, it produces intense pain and disorganization of the animal tissues in excess. Dr. Metcalfe observes, "that caloric is a self-active principle, which has not only the power of motion within itself, but that of giving motion to all other bodies. Witness its effects upon the particles of water—now coherent and constituting a solid; now gliding easily over one another and forming a liquid; and next flying apart in the shape of an elastic vapour, which gains power with every additional degree of caloric, until it upheaves continents, and makes the solid crust of the globe tremble."

All the meteorological, and most of the physical phenomena that take place on the surface of our earth, are simply due to variations in the quantities, or in the effects, of the caloric that is ceaselessly emitted from the sun. "Were it not for the heating power of the sun, there would be no contractions and expansions of the atmosphere, therefore, no winds. But in the present order of things, not a single atom of the great aërial ocean is quiescent for a single moment of time." It is now admitted that the whole theory of geological dynamics is immediately connected with the agency of caloric, and the Doctor has most admirably connected the science of geology with that of astronomy and general physics; and this part of his work should be read by every enquirer after truth.

He has arrived at the following conclusions:—

First—"That cohesion, chemical affinity, and capillary attraction, are modifications of that universal force by which planets and all other bodies are held together.

Second—" That the particles of all bodies are surrounded by, and intimately combined with, an exceedingly subtile, active, and mobile principle, which in certain proportions holds them together, but in larger proportions separates or decomposes them.

Third—" That the prevalent theory of physics, which ascribes the phenomena of attraction to the inherent, or immaterial properties of ponderable matter, is fallacious, and wholly unsupported by evidence.

Fourth—"That there is no such thing as a perfect *vacuum* in nature; neither in the pores of bodies, nor in those widely extended pores of the universe, termed the planetary spaces.

Fifth—" That the *inertia* of matter is a philosophical fiction; because there is nothing quiescent in nature, or which possesses the *power of not acting;* neither in the starry heavens, nor in the frame of the earth. The sun revolves on his axis, the planets around the sun. The air, the ocean, and the solid ground, are for ever in motion. The molecules of plants and animals are in a state of rapid circulation and change. Yea, the invisible atoms of inorganic matter are in a state of perpetual oscillation and transformation.

Sixth—"That the 'unknown hypothetical æther,' of Sir Isaac Newton, is identical with a true physical agent; the properties of which may be ascertained by the various mechanical, chemical, and physiological effects it produces; that it causes the aggregation and chymical union of bodies, whether simple or compound, by virtue of its *attraction for ponderable matter, and not by pressure*, as supported by Newton; while it causes evaporation, gasefaction, explosion, with all the separations and expansions of matter by virtue of its *idio-repulsive power*.

Seventh—"That if the earth were wholly deprived of caloric, it would become a stupid mass of inert and chaotic matter, without form, and void of all power of attraction and repulsion of solidity, fluidity, &c.

Eighth—"That the total extinction of the solar fluid (if such a thing were possible), would mark the reign of everlasting stillness and death; that the same æthereal principle which lights up the universe with radiant glory, directs the planets through their orbits, and preserves them in a state of perpetual motion, circulation, and renovation.

Finally—"That caloric is the first of second causes."

I quote these observations more with the view of pointing out the importance of this subject, than of offering any practical remarks.

CHAPTER III.

HYDROGEN.

Hydrogen plays an important part in the living animal, in producing its heat, for it combines with the carbon, and then with the oxygen, when they are thrown off through the skin and lungs in the form of oxydised products or carbonic acid. Oxygen in the respiratory process consumes, without exception, all such substances as are capable of entering into combination with it. The absence of hydrogen is the reason why carbonic acid is the chief product of respiration; for, at the temperature of the body, the affinity of hydrogen for oxygen far surpasses that of the carbon for the same element.

An adult man consumes about fourteen ounces of carbon daily, and hence all organs contain it in certain proportions; he also takes nitrogen at the rate of about 17 per cent., and in this proportion it is contained in all his organs and his blood, and he obtains this from certain food that contains it, and not from the atmosphere. Water and fat are, however, constituents of his body that do not contain nitrogen, yet, are equally required for the vital functions; they enable an animal to live much longer without food than an animal not supplied with them; because, that which serves for its nutrition, is identical with those parts of its organization which are to be renewed, or in other words, the animal organism and its growth are dependent on the reception of certain principles identical with the chief constituents of blood; because, it is incapable of creating blood out of other substances which do not already contain the chief constituents of that fluid; hence, probably arose, in a comprehensive sense, the Levitical aphorism, "in the blood is the life thereof." Animal organism can only give form to blood, which seems to hold an intermediate state between the dead matter of the external world, and the substance of the living body, and contains matter for nutrition and matter for excretion. Yet, the animal organism has the power of producing an extensive series of compounds differing in composition from the chief constituents of blood: but these last, which form the starting-point of the series, Liebig says, it cannot produce.

The animal organism is a higher kind of vegetable, the development of which begins with those substances with the production of which the life of an ordinary vegetable ends. The first substance capable of affording nutriment to animals, is the last product of the creative energy of vegetables; hence that endless series of compounds, which precludes a blank or interruption, and which begin with carbonic acid, ammonia, and water, the sources of the nutrition of vegetables, and includes the most complex constituents of the animal brain. Liebig also says, "that the substance of the cellular tissues and of membranes of the brain and nerves cannot be produced by vegetable matter.

The seemingly miraculous operation in the productive agency of vegetables disappears in a great degree, when we reflect that the production of the constituents of blood cannot appear more surprising than the occurrence of the elementary principles of the fat of beef and mutton, in cocoa-nuts, of human fat, in olive-oil, of the principal ingredients of butter, in palm-oil, and of horse-fat and train-oil, and in certain oily seeds. Between the vegetable kingdom which is formed of inorganic matter, and the animal kingdom formed of organic matter, a beautiful connexion subsist for the support and continuance of both."

Vegetables receive their nutriment direct from the earth and the air; from the latter they absorb carbon, and throw off oxygen from the other, component parts of their nourishment; whilst the animal kingdom absorbs the oxygen, which combines with certain component parts of the animal, and is afterwards thrown off as carbonic acid, and thus constituting the essential difference between the condition of the plant and animal. Vegetable life generates matter adapted for the nutrition of animals, out of the inorganic substances, which afford to plants their principal constituents, viz., carbon and nitrogen. The latter are again returned by the animals during life, and after their death, when decay separates their chemical compounds, into carbon, nitrogen, hydrogen, and oxygen.

Graminivorous animals live upon vegetables; and the most nutritious and best to make the blood develop the organs of such animals, are vegetables which contain certain constituents that are rich in nitrogen, without which they cannot be nourished. Nitrogen exists in all plants more or less, but in the seeds of different kinds of grain, roots, and in juices of vegetables, it is found most abundant.

The nitrogenized vegetables present their nutriment in three forms of *vegetable fibrine, vegetable albumen,* and *vegetable caseine.* Chemical analysis of these substances proves that they contain the same organic elements united in the same proportion by weight, and identical in composition with the chief constituents of blood, animal fibrine and albumen, and are thus ready formed to make blood, as far as regards their composition. Vegetables always contain a certain quantity of iron, which gives the color to the blood of animals.—Thus the blood of the graminivorous animal has in it the very same principles as the carnivorous animals obtain, ready formed, from the body of the graminivorous animal. In the latter, vegetable fibrine and albumen take the same form in their stomach as the animal fibrine and albumen take in the stomach of the carnivorous animal Hence, it appears that the development of the animal organism and its growth, are dependent on the reception of certain principles identical with the chief constituents of blood, not made by vital force; that the animal organism has the power to form an extensive series of compounds differing in composition from the chief constituents of blood, and, doubtless, the process of digestion for the development of the organs of the carnivorous animal is more simple than in graminivorous animals, since the former feeds directly upon the identical constituents of his body.

The flesh and blood consumed as food, yield their carbon for the support of the respiratory process, to form heat by uniting with oxygen, while its nitrogen appears as uric-acid, ammonia, or urea, and the nutrimental portion destined for the reproduction of organized tissues. It is by means of the circulation that a current of oxygen is conveyed to every part of the body. The globules of the blood, which in themselves can be shewn to take no share in the nutritive process, serve to transport the oxygen, which they give up in their passage through the capillary vessels. Here the current of oxygen meets with the compounds produced by the transformation of the tissues, and combines with their carbon to form carbonic acid, and with their hydrogen to form water. Every portion of these substances which escapes this process of oxydation is sent back into the circulation in the form of bile, which by degrees completely disappears in the vital process. The carbon and hydrogen of the bile is given out through the skin and lungs as carbonic acid and water, bile being an element for respiration and for the production of animal heat.

Liebig says, that bile in man is a compound, and is daily secreted in amount from 9.640 to 11.520 grains, that is, from 45 to 56 times as much as can be detected in the matter discharged by the intestinal canal, consequently it combines with the oxygen in its passage through the intestines and the blood vessels, and is converted into a series of necessary compounds.

CHAPTER IV.

THEORY OF DISEASE.

The analysis of blood has been so little studied by the medical profession, until of late years, that we have comparatively but few observations to direct us regarding its diseased condition. Liebig's Organic Chemistry will doubtless be the means of rapidly increasing our pathological knowledge, and thereby removing the too general impression amongst practitioners that since animal chemistry has hitherto failed to add much to our pathological knowledge, that it is not likely to do so for the future. The continuance of every healthy vital function, and the power to resist disease, as well as the restoration from the effect of the latter, must always depend upon healthy blood; and Liebig observes, "that every substance or matter, every chemical or mechanical agency, which changes or disturbs the equilibrium between the causes of waste and supply, in such a way as to add its action to the causes of waste, is a cause of disease." In medicine, every abnormal condition of supply or of waste, in all parts, or in a single part of the body, is called disease. In different temperaments, habits, and periods of life, the same cause of disease will produce very different effects; hence, the importance of a just application of remedial principles, because the same method of cure may restore health in one individual, which if applied to another, may prove fatal in its effects. But in all cases, due regard must be paid to the vivifying agency of the blood, for it must ever continue to be the most important element in the restoration of a disturbed equilibrium, and the ultimate and most powerful cause of a lasting vital resistance, as well in the diseased as in the unaffected parts of the body. Thus, in some diseases, oxygen may be administered with the greatest advantage to render diseased products harmless, or to destroy them, or to prepare them for expulsion from the body, and restore the equilibrium of the body. I have found inhalation of oxygen of very great use in cases of indigestion, nervous debilitated conditions of the mind and body, and in chronic affections of the liver and kidneys, asthma, paralysis, uterine affections, and externally applied, it is of benefit in chronic swellings of the joints. Inhalation of oxygen is also of great use in debilitated muscular cases, arising from a sedentary mode of life in warm rooms, wherein the expanded air contains but little oxygen; hence, stupor, head-ach, langour, and inactivity of the mind and body, with shifting pains, and general irritability, &c.

Persons *leading a sedentary life*, seldom exert themselves sufficiently to expand their lungs so as to change the volume of air in them, consequently the black blood returned by the capillary vessels and the veins to the heart, in order to pass through the lungs, does not meet in the latter a sufficient volume of oxygen to oxidize the iron contained in it for arterial circulation, so that the blood is not sufficiently vitalized to stimulate the different secerning organs. Thus, when the lungs, liver, kidneys, and skin, fail to part with the carbon of the blood, by converting it first into carbonic acid, during its circulation in the lungs, the secretions become vitiated, and disease is established. In elderly people obesity, gout, rheumatism, paralysis, stupor, mental distress, and cutaneous affections, are thus produced.

In our climate, during summer, when persons eat much, and drink wine or spirits freely, the carbon and hydrogen which they consume, either from the debilitated condition of their digestive organs, or the want of sufficient oxygen in warm rooms, are not properly oxydized, that is, converted into carbonic acid and water, and the unassimilated nitrogen of the food, along with the unburned or unoxidized carbon, is too tardily expelled in the urine, or by the intestines, and thus diseases often arise, and functional or organic affection of the liver, kidneys, or digestive organs are produced. In winter, when persons take exercise in the open air and inspire oxygen freely, and thereby increase the desire and necessity for food, containing carbon and hydrogen, an increase in the same ratio of the generation of heat in the body takes place in order to counteract the cold. Hence, in warm climates, seasons, or rooms, the whole of the carbon introduced into the system by a generous diet is not consumed, the temperature of the air is too high, and the oppressive heat does not allow of an increase in the number of respirations by active exercise, in order to proportion the waste to the amount of food taken, and disease of the liver, lungs, kidneys, or stomach, ensues. This is the true cause, I believe, why we have so many cases of indigestion, nervousness, and kidney affections, and oxygen gas, judiciously administered, is the best means of cure.

Diseases of the respiratory organs frequently arise, I believe, from congestion of the vessels with blood, containing an oxydised carbon. The fact that consumption is less frequent in the northern countries, as Russia, Norway, and even England, than amongst the inhabitants of France, Italy, India, and Malta, has justified my reproach of the practice of sending our consumptive patients to the south, instead of the north, where the atmosphere is dry and contains most oxygen, which was intimated in my last work upon "Irritation of the Spinal Nerves, as the source of derangement of the principal organs of the body."

Further experience has confirmed my opinion that oxygen is not the cause of phthisis, or that it increases the disease when established; for if it did, the disease would be more common in the northern than in the eastern climates, where the volume of oxygen is necessarily greater in condensed air, than in the heated and expanded air of southern climes; nor would Priestly have found inhalation of oxygen so advantageous as he did, in those cases he has published, or myself, in some cases, and particularly in cases of chronic bronchitis. In many diseases substances are produced, which are ordinarily incapable of assimilation, but by a low diet, or an extra supply of oxygen, they are readily removed.

All vital motion and activity arises from the mutual action of the oxygen absorbed from the atmosphere by respiration, during every moment of man's life, and the elements of the food. Man daily receives into his system 32½ ounces of oxygen, and ought, therefore, to receive in the shape of nourishment, as much carbon and hydrogen as would suffice to supply 24 pounds of blood with these elements. Hence, a deficiency of food, or a want of power to convert it into a part of the organism, both indicate a want of resistance, and either may be a negative cause of the cessation of the vital process, or in other words, produce death.

A good atmosphere, freely supplied, oxygenates and destroys numerous impurities that would otherwise lurk in the system, and develop disease. The blood then is subject to incessant varieties in its precise chemical constitution, and the lungs discharge from the blood large quantities of offensive volatile products. The respiratory tubes should be clear of disease or obstruction, to enable the lungs to vitalize the blood, the product of food, even where there is abundance of pure air, and how much more so in a close and impure atmosphere; a man in a bad atmosphere cannot probably eat more than one-half the quantity he requires in pure air; hence, disease depending upon debility ensues in the lungs, or in some other organ most prone to disease. Thus disease of some organ may ensue, depending upon starvation, although the appetite had been daily satiated. I have, therefore, found the utmost advantage from administering oxygen to persons moving in the higher circles, and persons much engaged in close rooms, as lawyers and merchants. It not only creates an appetite, but quickly dissipates symptoms depending upon deficient action of the secreting organs. In many cases, I have found advantage in placing patients in body baths, containing a certain portion of oxygen, added to the common atmospheres; it is quickly absorbed by the skin, produces its usual effect of exhilarating the spirits and exciting the torpid secretions, and is particularly serviceable in certain chronic affections of the skin.

The gratifying result of my experience in various cases, would scarcely be conceived by persons not acquainted with the various diseases in which the lungs perform a very promiment part, in relieving the body from the noxious products that abound in it, and in which the per centage of carbonic acid discharged was considerably beyond the amount evolved in health. Indeed, offensive odours, discharged from the lungs and surface of the body, in particular stages of disease, indicate the great importance of allowing every facility to the lungs and skin to operate according to the laws that regulate the diffusion of gases. The functions of the animal economy appertaining to respiration and transpiration depend upon a full oxygenating influence of an abundance of pure air.

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CHAPTER V.

OXYGEN.

Oxygen is the principal element that comes into play in all the more peculiar effects produced by the action of the air on the living frame. It forms one-fifth part of the air, by measure, and is an agent equally singular for the extent of its distribution, and the important purposes which it performs in the general economy of the globe. It constitutes eighth-ninths of the water of the globe, by weight, and about one-half of its more abundant solid contents—so far as has been ascertained; whilst its power on the material world is more marked than that of any other substance, by the property it possesses of sustaining slow combustion with all varieties of animal and vegetable matter.

When oxygenation is imperfect from excess of food, defective respiration, or other causes, the system is generally overburdened with fat, or the liver and kidneys become deranged in their functions, in consequence of the carbon of the fat, circulating in the blood, and not being converted into carbonic acid and thrown off by the lungs, a process denominated by the immortal Harvey "ventilation of the blood." The oxygen of the air, absorbed in the lungs, is circulated by the heart and arteries through every portion of the body, enabling all the organs of secretion to prepare and remove from the blood the respective fluids necessary for the continuance of health and life; hence, oxygen is called vital air, and the blood, the "vital stream." The necessary heat of the blood, is, probably, kept up by the conversion of the elements of food into oxydized products, by the agency of galvanic electricity, the absorption of light, or by friction, that is, the conversion of one kind of motion into another, but which affects our senses differently. Heat varies in degree according to the intensity of the chemical action, which produces it; for instance, in man, the quantity of oxygen consumed varies according to the temperature and density of the air, the degree of motion, labour, or exercise; the amount and quality of the food, the compara tive warmth of the clothing, and, also, according to the time when the food is taken. Hence, the importance of the judicious application of oxygen to remove the cause of disease; the unoxydized material remaining in the system of the sedentary, and of persons indulging too freely in food and undue warmth, as well as in persons of debilitated frame, who cannot forego the accustomed luxuries, or take the necessary exercise, in order to consume the superabundant carbon. The healthy condition of the secreting organs cannot be maintained without due consumption of oxygen or vital air, and by its use I have recovered the normal functions of the vegetative and generative organs, which had previously suffered from the causes above mentioned.

The good effect of *oxygen* in removing the *poisonous effect* of carbonic oxide gas, is seen in a case published in the second edition (p. 714), of Dr. Christison's work on poisons. A gentleman, after exhausting the air of his lungs, "inhaled pure carbonic oxide gas, three or four times, upon which he was suddenly deprived of sense and motion, fell down in a state of stupor, and continued for half an hour apparently lifeless, and with the pulse nearly extinct. Various means were tried for rousing him, without success; till, at last, his lungs were inflated with oxygen gas. Animation returned rapidly; but he was affected for the rest of the day with convulsive agitation of the body, stupor, violent head-ach, and quick irregular pulse; and after his senses were quite restored, he suffered from giddiness, blindness, nausea, alternate heats, and chills, succeeded by feverish, broken, but irresistible sleep".

Venous blood, before reaching the heart, is made to pass through the liver; arterial blood, on the other hand, passes through the kidneys: and these organs separate from both all substances incapable of contributing to nutrition. Those new compounds which contain the nitrogen of the transformed organs, are collected in the urinary bladder, and being utterly incapable of any further application in the system, are expelled from the body, and their amount may be ascertained by analysing the urine. Those, again, which contain the carbon of the transformed tissues, are collected in the gall-bladder, in the form of a compound of soda,—the bile, which, passing into the abdomen, mixes with the chyme. All those parts of the bile which during the digestive process do not lose their solubility, return during that process into the circulation in a state of extreme division."

To produce healthy secretions, or the proper change of the elements of food—exercise in fresh air is necessary; the want of it, and undiminished clothing, are equivalent to a deficient supply of oxygen, for when these circumstances occur, the animal absorbs much less oxygen than is required to convert into carbonic acid the carbon of the substances destined for respiration. Excess of carbon, obtained from food, over inspired oxygen, must create fat, or disease, according to the predisposition of the body; hence, animals stall-fed, become fat much sooner in warm and confined air, and by being kept quiet, than in the open air with liberty to exercise themselves. The liver also of geese becomes soft and very large when kept quiet in warm rooms. For the same reason, human beings are subject to obesity and vitiated secretions, as gall stones, stones in the kidneys and urinary bladder, enlarged glands, gout, rheumatism, nervous pains, indigestion, acidity, debility, lowness of spirits, and nervous symptoms of infinite variety of form.

It cannot be denied, that uncontaminated or pure air is essential to health, and even to life; and every one knows, or should know, that air which has once been breathed, is not fit to be inhaled again, and that if breathed again repeatedly it induces langour, head-ach, and, in the last degree, death. In Dr. Reid's work on Ventilation, he observes, " Were chemicals employed to absorb carbonic acid and moisture, and to exale oxygen, from time to time, there is no limit to the period that life might be sustained, so far as air is necessary."

It appears to be universally admitted, that a low diet diminishes the necessity for much air, and that, on the other hand, where there is little air, there cannot be a great appetite for food. In the present state of society, a large share of the evil not unfrequently attendant upon dinner parties, does not arise so much from individuals having taken more than their constitution requires, or can digest, but rather from the vitiated air with which the system is usually surrounded at such periods.

Notwithstanding all that has been said upon the importance of fresh air, yet few have acquired, to its full extent, the taste for pure air, and fewer still provide for the salutary enjoyment of it. In fact, pure water and pure air are the two essentials to the most important functions of healthy life,—respiration and perspiration; to the soundness of the skin and the lungs. I have found that persons after dinner parties and balls have been quickly relieved of their dry skin, head-ach, and lowness of spirits, by inhaling oxygen gas a few times; indeed, I have often been told by my patients, that they never had a gentle perspiration over their bodies, except after inhaling the oxygen, which always ensured a cheerful state of mind, instead of that miserable feeling with which they had been previously afflicted.

During the winter, in large or small parties, in more or less closed rooms, it can scarcely be possible for the company to be supplied with the required volume of fresh air, since each human being inhales about a gallon of pure air each minute, and more in volume of impure, or expanded air, which is sixty gallons an hour! Suppose, then, that each person were to inhale his supply from a reservoir of pure air, through a pipe applied to his mouth, so that none but what was perfectly pure could reach his lungs, it is plain that there should pass, into every apartment, sixty gallons an hour for each person, which would give to ten individuals six hundred gallons. Besides, in large parties, pure air will not readily enter apartments filled with contaminated air, even supposing the doors or windows were allowed to be left open for the purpose; large fires should be kept up to draw air into the rooms, and to carry the vitiated air up the chimney. Thus fires are salutary, for they draw in more air than they consume, and thus keep up a constant circulation.

Private families, merchants, and lawyers, inhabiting small rooms, suffer for want of a sufficient quantity of vital air, particularly in seasons when fires are not necessary to warm the body, as then the atmosphere cannot enter to oxydize sufficiently their blood, or to stimulate their organs to the performance of their respective vital functions. I have often observed hysterical paroxysms, spasm, cramps, indigestion, &c., attacking young persons when thus confined in closely inhabited rooms, resisting the usual remedial means, because the cause of the morbid action was unsuspected by the practitioner.

Spasm, cramps, and langour, are affections of the muscles, or of their fibres, depending either upon causes in these organs themselves, or on sympathy with causes influencing the nerves of the brain or spine, or on the condition of the blood, which has not been properly oxydized, or which is charged, as Liebig supposes, with peroxide of iron; hence affections of nervous centres arise in an infinite variety of forms.

When spasm and cramps occur without direct local injury to the nerves of the affected muscles, they generally indicate a much greater derangement in the system than is generally associated with the terms of spasm and cramps. In all cases, the nerves of the affected organs should be traced to their origin, in the centres of the nervous system, the brain, or spine. The healthy functions of the brain, liver, kidneys, skin, and generative organs, is maintained by the condition of the blood after it passes through the lungs, inasmuch as their respective nerves depend upon the same cause for power to supply them with their requisite nervous energy; in short, the vital functions of the body depend upon the joint agency of the blood and nerves. In these conditions must be primarily sought, in the absence of mechanical injury, the cause of debilitated mental faculties; langour, palsy, spasm, cramp, functional and organic derangements of all the principal organs.

In inflammatory disease of the lungs, and of the kidneys, we invariably find that the patient quickly becomes delirious, in consequence, most probably, of the poisonous effect of the black blood upon the brain, which has not been properly oxydized in the lungs, or the nitrogenous portion of it removed by the kidneys; and in affections of the liver, the patient is afflicted invariably with considerable despondency, in consequence of the carbon of the blood not being oxydized and removed. Thus, the prisoners in the black hole at Calcutta, became quickly delirious, in which state many died immediately, and the rest soon after of debility, and of symptoms resembling scurvy.

Every interruption to the nutrimental process, or to the transformation of the blood into new compounds, under the influence of oxygen introduced into the circulation, must establish disease. Secretions of the different organs must of necessity contain the products of the metamorphosis of the tissues, no longer required in the system. Thus the urine contains those products of metamorphosis which possess the most nitrogen, and the bile, those which are richest in carbon. Liebig says that " from all the tissues which in the vital process have been transformed into unorganized compounds, it is clear that the elements of the bile, and of the urine, added together, must be equal in the relative proportion of these elements to the composition of the blood."

Uric-acid is formed by the kidneys, from wine and rich fat food, which, when quickly secreted, disappears by administering oxygen, probably, aided by the influence of the nervous energy, or vital force. When the uric-acid diathesis is present, and when the acid is unduly secreted, muscular exercise in the open and cold air, to a degree to produce perspiration freely, is recommended, because oxygen in the latter temperature is greater in a given volume, and exercise must be brisk to produce perspiration, and respiration must be proportionally quick. Reading out loud, singing, and frequent respiration, have been recommended for the same purpose, *i. e.* of increasing the amount of oxygen absorbed; warm rooms, rich diet, and more sleep than is necessary to repair fatigue of the previous day, are to be avoided.

According to Liebig, substances which contain no nitrogen, by combining with the oxygen which has been inspired, hinder the action of the oxygen on the uric-acid; therefore, a moderate quantity of meat, with a much smaller quantity of bread, is the best diet. Thus, the oxygen will find but little non-nitrogenous matter in the blood, and will act more readily on the uric-acid, changing it into urea and carbonic acid. Dr. Wilson Philip in his paper on diet, published in the sixth volume of the Medical Transactions (page 212), writes:

"That a diet composed of a large proportion of animal food tends to lesson the disposition of lithic-acid, and to increase that of the phosphates." In the uric-acid diathesis, patients will not generally conform to the rules of exercise; I have, therefore, directed the above rules of diet, and administered oxygen, and gentle aperients which act upon the liver, and have thus diminished quickly the fat and non-nitrogenized matter in the blood. When the evacuations are dark-coloured, the action of the liver is torpid, and calomel, colocynth, aloes, colchicum, &c. are beneficially administered. I generally administer some of these remedies, or turpentine, before I commence with the oxygen. When this gas is administered, I give it in proportion of one volume to twelve or sixteen volumes of atmosphere, once a day. I thus soon produce a softness of the skin, with gentle perspiration, that greatly relieves the patient from his prior heated, dry condition.

In cases of torpid or vitiated secretions, I am quite satisfied that flannel next the skin, warm bed-clothing, rooms, &c., are highly objectionable. In 1834, I published my Introductory Lectures, on Deformities, &c., wherein I pointed out the injurious effect of flannel next the skin in certain temperaments. In Liebig's work on Organic Chemistry, (page 253), he thus writes: "Let us now suppose, that heat is abstracted from the whole surface of the body; in this case the whole action of the oxygen will be directed to the skin, and in a short time the change of matter must increase throughout the body. Fat, and all such matters as are capable of combining with the oxygen, which is brought to them in a larger quantity than usual, will be expelled from the body in the form of oxydized compounds."

When defective oxygenation exists, the various preparations of iron should be given, to increase the amount of red particles in the blood, and thus in the capillaries influence the quantity of oxygen which is absorbed; I have also found, that in the serous temperament, the benign influence of inhaling the oxygen is increased, by the patient at the same time taking iron. In lax and debilitated cases, this mode of treatment is highly to be commended. Absorption of oxygen by the skin, is another pleasant mode of administration. Gases act upon the constitution when thus absorbed (as substances do when mixed in water, or in steam baths), either upon the nerves or upon the blood; on the nerves as stimulant, or sedative; and they remove from the blood extraneous substances which may have been absorbed into it. Liebig, in his Animal Chemistry (p. 62), says, "The acetate of potash, given as an enema, or simply as a bath for the feet, renders the urine alkaline." Doubtless the benefit derived at Töplitz, by those subject to gout, depends on the absorption of alkaline matter by the skin. The baths at Töplitz are recommended to be used early, or before food is taken in the morning, in order that the secretions lost during the night, may be made up by absorption from the bath ; for, it is well known, that if the patient either drink the waters, or any other fluid, the absorption and the effect of the bath are much less. The treatment of diseases by oxygen gas, and other factitious airs, and medicated baths, is but beginning to excite attention.

It is in the highest degree probable, that the amount of oxygen may be increased in the system by means of nitrous oxide. Professor Graham states, that when in solution, it possesses none of those stimulating properties which it exercises when absorbed as a gas. I found lately the advantage of giving oxygen, in the case of a gentleman who consulted me respecting the great inconvenience he experienced by his stoutness;

he could scarcely walk, talk, or breathe without inconvenience. Hat-makers, who necessarily breathe chlorine gas, according to a statement made by a Belfast hat-manufacturer, and published in Dr. Christison's work on poisons, never become fat; and all who join the workmen fat, soon become slender and lean, and yet retain their health, and live to a great age. It appears that the poisonous effect of the chlorine is overcome by habitual exposure to its influence; the only inconvenience to which it temporarily gives rise being acidity of the stomach, which is readily combatted by the administration of chalk or other anti-acids.

It is an established fact, that no animal will fatten upon food strongly impregnated with salt. The salt furnishes, by decomposition, a superabundance of alkali to the blood, and the oxygen, acting simultaneously upon the living tissues, gives rise to scurvy. Sailors, confined to hard junk, on board ship, in long voyages, being almost entirely deprived of non-nitrogenized food, become lean, and ultimately suffer from scurvy. A knowledge of these facts, led me to direct my patient to use a diet in which salted provisions formed the chief item: at the same time, as an auxiliary, he was directed to take active exercise. His bowels were regulated by gentle aperient medicine, and he inhaled, daily, oxygen gas. By these simple measures he was, in the space of a few months, reduced to a healthy standard, and the morbid deposition of fat was gradually absorbed.

It is necessary to avoid warmth by dress, fires, &c., because oxygen is the active cause of the waste of matter in the animal body; and is greater in quantity and effect in a cold than in a warm atmosphere. Liebig observes, that "Vital power requires for its manifestation a high temperature, and is diminished by muscular motion (p. 243), so that at equal times and temperatures, the amount of change in the albuminous tissues, for instance, may be taken to be directly proportional to the amount of muscular action (p. 245); and, in equal times, with equal muscular action, if we surround a part of the body with ice or snow, there occurs, more or less quickly, in consequence of the loss of heat, an accelerated change of matter (p. 252). Thus we may, indirectly promote change by hastening the formation of the ultimate products from these tissues.

"This may be done by increasing the action of the oxygen, by multiplying the blood globules, and by abstaining from non-azotised food, also by giving alkali to promote the formation of bile, or choleric acid, and by giving an excess of albuminous food, which may supply the waste of the tissues." (p. 259). Liebig, also, has shown that oxygen is by far the most important agent in these changes, and that the quantity inspired varies with the temperature, dryness, and density of the air. An increase of its amount may be taken into the body by exercise, because the consumption, in equal times, may be represented by the number of respirations, and the number of respirations is smaller in a state of rest than during exercise or work, or least during sleeping, and greatest in exertion.

Therefore, to lay in bed but little, and to breathe cold air, are necessary to remove undue fat. We may also increase the action of oxygen upon the body, by diminishing the quantity of those substances on which the oxygen acts, by aperients, and particularly by those medicines which produce a secretion and evacuation of bile. The bile may be considered a higher carbonaceous substance, which Liebig considers to be re-absorbed into the system; and, when acted on by oxygen, assists in the formation of animal heat.

Other physiologists look on the excretion of bile as supplementary to the excretion of carbonic acid by the lungs; thus, Carpenter, in his Physiology, (p. 425), says "By the liver, the carbon is excreted in the form of a fluid, whilst by the lungs it is thrown off in a gaseous form." Purgatives are indicated, in all cases where it is desirable to lessen the quantity of carbon in the blood, in order to permit a freer action of oxygen on the uric-acid, tissues, &c. By various preparations of iron, we may also increase the amount of red particles in the blood, and thereby its capacity for oxygen. Since the above principles are applicable for the reduction of fat, and also of power generally, the opposite principles must be correct to obtain power and flesh. Indeed, we know, that by diminishing the amount of alkali in the blood, and by giving non-nitrogenous food, the scurvy is cured or prevented, in consequence of such substances being acted on, instead of the tissues of the body.—Hence, vegetable acids, as sugar, wine, beer, wort, treacle, potatoes, &c., have been used with the best effects to cure scurvy and restore the physical power of the prostrated and scorbutic sailor. In such a case, it is extremely probable, that when excess of alkali exists in the blood, the vegetable acids, instead of passing through the system, combine with the alkali; and the salt which is formed, after being converted into carbonate, by the action of the oxygen, is carried out of the system.

The prior debility, experienced by sailors, before the physical symptoms of scurvy develop themselves, is doubtless the consequence of the undue quantity of alkali in their blood, derived from their salted provisions, and the consequent action of oxygen upon the tissues of their bodies. Dr. Beddoes, and others, have observed that scurvy breaks out generally after a storm, not, however, as the consequence of the agitation or commotion of the elements, but arising from the extra physical duties required from the men at those times, thereby rendering them still more obnoxious to oxygen.

Scurvy, in all respects, is a converse disease to gout, which is the result of long continuance of the secretion of uric-acid, from excessive eating, sleeping, want of exercise, constipation, and little secretion by the skin, which all tend to lessen the amount of oxydation which is necessary to remove those substances which result from the metamorphosis of the tissues of the body. In short, as Professor Liebig observes, the practice recommended for the prevention and cure of gout, in all ages, has been temperance, early rising, regular walking exercise in the open air, alkalis, and medicines to act upon the liver and the skin, clearly indicates that the want of oxygen is the cause of gout, and the promotion of its action the only means of effecting a cure, or of preventing a return of the affection.

When men lose the desire for active exercise they are apt to indulge unduly in the luxuries of the table, warm rooms, and much sleep; consequently the oxydation of substances necessary to be removed from the blood does not take place, and from this cause arise gout, dyspepsia, nervous pains, apoplexy, palsy, stones in the gall and urinary bladders.

The cure of gout, and its prevention, are most assuredly to be effected on the principles I adopted with my lusty patient—oxydation of injurious substances—the objects to be sought, are a change in the blood, and free perspiration, in order to overcome that acid state of the secretions of the skin, the stomach, and the urine, which arises in gout, from a want of the action of oxygen on the non-nitrogenous principles of the food. The effects are greatly aided by administering internally,—or assisting externally by baths,—such medicines as soda, potash, or magnesia. The undecomposed acids, in the gouty system, for want of due oxygen, supplied by means of the skin, are neutralized by alkalies, and lactates, or acetates are formed; care should, at the same time, be taken, that all food from which acid is most readily formed in the system, be avoided, that is, all non-nitrogenous food, especially vegetables containing starch, sugar, &c.

The diet should be simple, and very moderate in quantity, because by eating heartily of animal food, the blood becomes loaded with excess of those principles which can only be carried off by the action of the oxygen. Abstinence acts somewhat in the same manner, as the inhaling factitious oxygen, that is, by supplying no fresh fuel, whilst respiration of oxygen remains undiminished to consume gradually the non-nitrogenous (carbonaceous) substances in the circulation. If respiration be quickened by muscular exertion, the effect will be greater by additional oxygen being absorbed. Liebig's views of the relation between gout and secretion of uric-acid, and oxalate of lime calculi, shew that their dependance is on the want of the action of oxygen, and my success in curing gout by inhalation of oxygen, confirm also the practical value of the theory; and also shews the facility with which urinary secretion may be altered, by the action of oxygen, as is seen by the fact, that uric-acid may be converted into carbonic acid and urea.

Nervous energy is obtained by food and sleep, and when these are insufficient to supply the vital force, general debility quickly ensues, with more or less irritability of the system, tending to, or concentrating itself upon, some organ that is least able to resist, and diseased action takes place according to the peculiar predisposition or temperament of the patient. Again, the latter consequences take place when too much food and sleep are indulged in, because the oxygen is not sufficiently inhaled by the lungs, and absorbed by the skin, to oxydize the blood, and to prepare for removal the useless matter of transformed tissues. Hence, this matter acts as poison and engenders disease, as venous congestion of some organ, muscular and painful nervous affections. Liebig observes that, "As an immediate effect of the manifestation of mechanical force, we see a part of the muscular substance loses its vital properties, its character of life; this position separates from the living part, and loses its capacity of growth, and its power of resistance. We find that this change of properties is accompanied by the entrance of a foreign body (oxygen) into the composition of the muscular fibre (just as the acid lost its chemical character by combining with zinc); and all experience proves, that this conversity of living muscular fibre, into compounds destitute of vitality, is accelerated or retarded according to the amount of force employed to produce motion. Nay, it may safely be affirmed, that they are mutually proportioned; that a rapid transformation of muscular fibre; or, as it may be called, a rapid change of matter, determines a greater amount of mechanical force; and conversely, that a greater amount of mechanical motion (or mechanical force expended in motion) determines a more rapid change of matter."

From this decided relation between the change of matter in the animal body, and the force consumed in mechanical motion, no other conclusion can be drawn than this, that the active or available vital force, in certain living parts, is the cause of the mechanical phenomena in the animal organism. The amount of motion, and the quantity of living tissues transformed are proportional to the quantity of oxygen inspired and conveyed to every part with the arterial blood, to form oxydized compounds by its union with separated substances from the living organs during their functional action. A small portion of oxygen serves to produce the change of matter, and to determine the separation of living parts and their conversion into lifeless compounds, as well as the formation of the secretions and excretions. Thus indolent, or very lusty people, who do not take exercise, are relieved of their cough and difficulty of breathing, torpid or vitiated secretions, &c., by the action of organs, induced by electricity, the influence of which, prepares what is thereby separated for the formation of secretions and excretions. Liebig says that, "Practical medicine has long since answered the question, 'what becomes in man of the compounds of proteine taken in excess; what change is undergone by the superabundant nitrogenized food?' The blood-vessels are distended with excess of blood, the other vessels with excess of their fluids, and if the too great supply of food be kept up, and the blood, or other fluids adapted for forming blood, be not applied to their natural purposes, if the soluble matters be not taken up by the proper organs, various gases are disengaged, as in the process of putrefaction, and the excrements assume an altered quality in colour, odour, &c.

Gentlemen who live generously, and leading a sedentary life, are continually met with, complaining of heated skin, clammy white tongue, head-ach, acrid eructations, oppressed breathing, fickleness, irritability, or considerable despondency, amounting to a desire to seek death, with disinclination to all mental or physical occupation, and with a very low degree, and even sometimes absence, of animal passion. Females are similarly affected, and this state is attended with considerable derangement of the uterine functions, or a total loss of the generative function, or power of conception; some fancy that they hear in their sleep, or even while awake, heavenly music, or a diabolical conversation, or recommendations, in a whisper, to destroy themselves.

Patients of the above description, are generally only functionally and not organically affected, and are capable of being quickly either cured or greatly benefited, by inhalation of oxygen, and the use of galvanism, and other simple remedies, and a judicious diet.

CHAPTER VI.

DISORDERS OF THE GENERATIVE FUNCTIONS.

Spermatorrhœa.—The extreme paucity of published medical information upon causes that influence depressingly the animal passions concerned in the generative function, is much to be regretted, since many healthy, and comparatively young persons, attribute the absence of natural feelings to premature decay, and passively submit to the inconveniences arising therefrom. Yet such patients would be most anxious to recover the healthy functions of other organs, as the secretion of bile, or the restoration of sight or hearing. This indifference in patients is generally, however, only apparent, and they refrain from applying for medical advice from misplaced delicacy; whilst others silently, both mentally and morally, suffer poignantly from disappointment attending the want of success in the treatment of their medical advisers. Finally, they become the dupes of those unprincipled fellows who advertise their obscene trash, in the "quacks' corner" of the newspapers, &c., to catch and plunder the unwary and anxious.

To prevent the dire consequences of such treatment, it is to be hoped that respectable medical practitioners will devote hereafter more attention than hitherto, both to the functional and organic derangements of the generative organs. I shall not, in the present work, enter into the varied and important subject; but I shall shortly publish my experience, in a distinct treatise, on spermatorrhœa, or involuntary emission, and other defective functions of the generative organs. A subject fraught with the deepest interest, both as regards the patient and society, and it is to be hoped that medical gentlemen will for the future investigate scientifically such diseases, and grasp from the destruction of quackery their afflicted fellow-creatures.

The secretion of semen being continuous, and not occasional, as is supposed by some, an adult, who leads a life of continence, must necessarily pass it daily; or, after urinating, or involuntarily in sleep, more or less frequently. These natural effects, alarm some people, and they readily believe the interested explanations of the impudent quack whose daily advertisements too often succeed in attracting the unwary.

It must, however, be admitted, that occasionally these effects are induced by general debility, arising from habitude, or vicious practices, or from irritability of the bladder, or rectum, engendering in the constitution an over-susceptibility, or insusceptibility of the generative organs, that occasionally induces disease of some vital organ, or nervous fits, such as epilepsy, &c.

When spermatorrhœa is a morbid affection, it is not only a frequent occurrence during sleep, but occurs unaccompanied by rigidity of the penis. A condition that continues so when sexual intercourse is attempted, and the act is therefore, incomplete, or the ejaculation of the semen is too precipitate, or painful, or not at all, with little or no pleasurable sensation, and impotence is thus established more or less complete. At this stage, the mind, memory, and physical powers, become debilitated, and the brain, lungs, heart, or bowels, fall into a chronic state of disease, terminating in partial or complete paralysis of the limbs, and the sufferer leads a miserable existence.

Indulgence in vicious school habits, (masturbation), or undue sexual intercourse during youth, are well known to occasion paraplegia, by producing softening of the spinal marrow, as if the excitement of the sentient nerves, and of the reflex actions, as they are called, ended in an alteration of the structure of the centre of the medulla. Such cases may be distinguished from those of caries, by the extremities being more or less affected, sensation impaired, and there is more spasm of the muscles than is usual with ordinary caries; the mind is weakened, so that the memory is defective, and the patient is subject to low spirits and fits of crying; the countenance is pale and the pulse feeble, and there is a down cast look of suspicion and shame, while no part of the spine can be fixed on as the exact seat of disease. When direct questions are put to them as to their habits, they will acknowledge their vicious habits, and frequently also, the vice of drunkenness. The intemperance is, also, a cause of paraplegia, and produces a want of power of retaining the urine for any length of time, and the bowels, unde these circumstances, are very costive, the patient is nervous and cries easily, is frequently convulsed, particularly after masturbation, or has twitchings of the limbs, whether they be in a paralytic condition or not; therefore, in paralytic cases of young people, the cause should be ascertained before the treatment is determined on, which must vary according to the cause, and more particularly in respect to the vicious cause.

Spermatorrhœa, in a morbid degree, not only occurs during sleep, but when the bowels or the bladder are relieved; thus, a continual drain is kept up upon the constitution, day and night; the latter, however, often ceases, in consequence of the former. When the seminal apparatus is inflamed, or irritable, and particularly that portion of it situated near the prostrate part of the urethra, the muscular ejaculators of the semen and urine become irritable, and are easily acted upon by small portions of those fluids from various causes; such as strictures, masturbation, gonorrhœal affections, and their injudicious treatment, intemperance, late hours, hæmorrhoids, fissures, strictures of the rectum, ascarides, and other intestinal worms. Neglect, also, in washing the sebaceous matter around the glands, under the prepuce, cause irritation, as well as absolute continence, by the consequent continuous distention of the vesiculæ seminales. In all cases, it is of great importance to determine rightly upon the cause of spermatorrhœa, in whatever degree it may be; whether it be inflammation, irritation, sympathy, habitude, or debility. In the absence of an inflammatory cause, Lallemand's treatment, by once or twice applying the nitrate of silver to the urethra, is decidedly the best; simple diet and preparations of iron must be added, with the cold douche twice a day.

The nitrate of silver may be dissolved in proportion of two to six grains to an ounce of water, and injected into the urethra, two, three, or four times a day; but, when this plans fails, then the caustic should be applied to the membranous portion of the urethra. A common bougie, or catheter, is to be first passed along the urethra, and when the urine begins to escape, mark the length on the instrument used, and an inch short of that length, is the armed caustic instrument to be applied, and twirled around the urethra, for about an inch and half of its membranous portion.

Aphoria or Sterility.—When this disease is dependant upon organic causes, it may be irremediable; but, it is often as difficult, and generally more so, to ascertain whether it be so, or dependant on functional derangement of a temporary duration.

It is not at all uncommon for a woman to give birth to children, seven, ten, fifteen, twenty, and even twenty-three years after marriage. Over susceptibility, an excited condition, or the opposite state of inertia of the uterine system, or of the nervous system, in general, are the prevailing causes. The latter condition is generally found in the nervous temperament, accompanied by leucorrhœa, the former, in the same cases, with painful menstruation.

Dysmenorrhœa is generally met with in persons who do not sufficiently exercise their muscular system, so as to exhaust that portion of the nervous energy obtained by food and sleep, and thus oxydize properly the blood and the carbon of the transformed tissues. Hence, dysmeorrhœa is common in the luxurious or indulged portion of the fair sex, and very seldom in those who are actively engaged in work, requiring muscular exertion. I have administered the oxygen in cases of sterility, with the utmost advantage.

In cases of leucorrhœa, which had resisted the usual remedial means, I have also found inhalation of the oxygen of much advantage, and believe that few of these cases may not be cured in the absence of organic causes, by oxygen, galvanism, and tonic medicines containing iron and ammonia. Two ladies, after having been married five and seven years, without having, I believe ever conceived, although, as usual, they said they had several mishaps, became patients of mine, in consequence of intolerable sufferings from dysmenorrhœa, and were not only cured by oxygen and electricity, but actually became pregnant, and gave birth to fine children, and one of the patients is again pregnant.

Sedentary habits, stimulating food, and warmth, engender those unfavourable conditions of the uterine system in which conceptions do not take place after marriage. There are numerous intermediate conditions between over rigidity, and laxity of the uterine system, unfavourable for the normal periodical and generative functions; yet I have not met with a single case in which the above treatment proved objectionable.

In using galvanism and electricity, it is well to mention, that the fluid should be passed frequently from the nipple to the sacrum, and from the latter to the pubis, and again from the latter parts to the mammæ. The well known reciprocal sympathy between the uterus and the mammæ, is indicated by the latter becoming tender or slightly full at the catamenial periods. The uterus sympathises also with the mammæ, for Dr. Rigby has found that hœmorrhage after parturition may be stopped by putting a child to the breast, although there be no milk; and it also acts in preventing a recurrence of hœmorrhage by exciting contraction of the uterus. The late Professor Gregory was consulted by a lady, who had repeated miscarriages, followed by dreadful hœmorrhage. Finding that the breasts were full of milk, he recommended a lusty child to be applied to them, and to continue to suckle for nine months; the plan not only stopped the hœmorrhage at the time but insured the next pregnancy, which terminated in a favourable time, and by the birth of a healthy, fine child.

The laborious poor are frequently prolific, and suffer but very little during gestation and parturition. Conception is favoured by an unstimulating diet and exercise, whilst the contrary habit is unfavourable, and thus suggest to my mind the use of oxygen, electricity, friction to the spine, and muscular exercise. The condition below that of robust health is more favourable for conception than the opposite state; thus we find poor Irish and Scotch women very commonly giving birth to ten, fifteen, and twenty children, yet, for want of proper food to sustain their strength to suckle them, more than one-half, or three-fourths die during infancy, and not uncommonly, all of starvation, or as an indirect consequence of low diet.

CHAPTER VII.

ON THE ADMINISTRATION OF GASES AND FACTITIOUS AIRS.

I SHALL now take a retrospective view of what has been done in pneumatic practice, which for the last forty years has been only sparingly pursued, in consequence of the inconvenience of its application, and the saving of time that is effected in ordering a pill or a mixture; thus, the public has been tutored to confide principally, in swallowing, at short intervals, nauseous medicines, as if inhalation of gases, rules for diet, and exercise, formed but insignificant, or not most important principles in the theapeutic art. Yet, ancient and modern authors, have commended medicated vapours, among whom may be named Hippocrates, Galen, Alberti, Thilenius, Beddoes, Lavoisier, Priestley, Hufeland, Cotterreau, Corrigan, Elliotson, Scudamore, and many others. In diseases of the respiratory organs, they found the usual mode of treating them futile, and tried, successfully, inhalation.

Although the proportion of oxygen in the atmosphere, is doubtless, the best for average health, still its volume must vary with the temperature of the inhaled air, consequently, medical men have found that in certain diseases, that an increase of oxygen gas, over the natural proportion in which it is fouind in the atmosphere, is exceedingly beneficicial, because oxygen, in warm close rooms, as I have already pointed out, is continually found to be insufficient to preserve health, whilst carbonic acid, under similar circumstances, is found proportionably too abundant; the latter circumstance, produces headach, dry hot skin, and lowness of spirits.

Those cases of indigestion accompanied by nervousness, are very common amongst the luxurious and the sedentary, or persons much engaged in over-warm or close rooms. In the summer, the air is much more charged with humidity than the winter; thus inhabited rooms of ordinary size, without a current of air, soon become over-charged by carbonic acid moisture. In consequence of the two latter causes, persons who enter a room from the open air, thus inhabited, feel depressed by its heat and closeness, whilst the inhabitant is complaining of chilliness. A small fire, even in the summer, is advantageous in a room numerously inhabited, in order to dry the air and produce a current to carry off the exhaled carbonic gas, and supply its place by oxygen, in order that the functions of the secerning organs of the inmates may be healthily performed.

The temperature of the body, even in a warm room, when insufficiently supplied with oxygen, is reduced below the standard that is engendered in the open air, although the individual may be complaining of a sensation of undue heat, amounting to feverishness.

I have constantly observed an increase of consultations soon after fires are left off amongst merchants, lawyers, and persons engaged in sedentary occupations who are congregrated during the day in confinement.

These cases, caused by atmospherical changes, are accompanied by nervousness, headach, acidity, dry hot skin, pain of the back and limbs, and general prostration of mental and physical power. Diseases of the skin are, also, frequently induced by the same cause, and removed like the other affections, by the judicious use of oxygen and tonics, as will be hereafter pointed out.

Persons of sedentary habits seldom sufficiently change the volume of air in their lungs, consequently insufficiently oxydized blood is allowed to circulate, and to derange the functions of the nerves of the brain and spine, and, thereby, more or less, all the organs of the body. Hence, in partial paralysis of the limbs and nervous affections, I have given patients most decided relief, by the inhalation of oxygen, by electricity, friction, and muscular action ; even in paralysis of a limb, the muscles recover their action by the above means ; the frequent directing the mind to the voluntary muscles will alone excite in them nervous energy.

There are a number of cases on record, where, from bad conformation of the heart, and adjacent great blood vessels, part of the blood only traverses the lungs; the rest passes into the arteries again in the dark disoxygenated state, in which it returns from the veins, and thus gives the individual somewhat the appearance of a corpse recently drowned or strangled ; the lips are a violet or dark blue or livid colour, as well as the skin and under-part of the nails. Such persons are always extremely feeble, slight exertion of the muscular system brings on weariness with panting for breath ; similar to what is experienced by persons ascending high mountains, want of oxygen is the cause most generally of these symptoms, or it may be in consequence of starvation, induced by a want of a change in the elements of respiration, in which case the oxygen consumes the tissues of the body; this is the case in sea-scurvy, the salt meat not containing oxgen, and the salt having a great affinity for oygen, the person is thus quickly reduced in strength. Muscular action consumes oxygen, as already stated upon the authority of Liebig, although the same theory was published nearly fifty years ago, by Dr. Beddoes, who, also, suggested, that had the prisoners in the black-hole at Calcutta, kept quiet, instead of making vehement struggles, many more might possibly have survived.

Dr. Beddoes relates the following experiment, amongst others, with two half-grown kittens, of the same litter, one was teazed to make efforts, for half-an-hour, and then put into an air-tight vessel, in which it lived forty-eight minutes; the other lived fifty-six minutes in the same vessel.

It was also proved by Dr. Beddoes, that an animal will live longer in a closed vessel, after having inhaled vital air (oxygen), than another without having done so; and that the same animal can resist extreme cold for several minutes longer, and also live longer when put under water. Since the time the work of Dr. Beddoes was written, the science of chemistry has made astounding advances; consequently we now readily detect many erroneous deductions made by him, and my practical observations, aided by our improved knowledge of chemistry, has enabled me to obtain a greater degree of success in the treatment of cutaneous affections, ulcers, &c., than was obtained at any time by Dr. Beddoes.

Dr. Ingenhousz first communicated to Dr. Beddoes, the fact that, carbonic acid gas will remove instantly the pain arising from removing the protecting formation after a blister. This was tried by Dr. Beddoes, and found to be true. I have applied this gas is painful ulcers, and in two cases of cancer, with most satisfactory results; one of the cases is now under treatment. I have also found that the bisulphate of carbon is exceedingly useful in chronic scrofulous tumours, in allaying pain and dispersing them. Cloride of carbon has been of late recommended in cancer; doubtless the beneficial element of this compound, is its carbon. The ligneous naptha has also of late been found, in bronchial affections, to allay the cough, and lesson the secretion of phlegm, and asserted to have cured tuberculous pthisis. In many cases, I have had an opportunity of trying the effects of this remedy, and am satisfied it is a valuable medicine in chronic bronchial affections; but that it is capable of curing tuberculous consumption, I have in many trials had no satisfactory evidence; although, I am bound to say, it has generally allayed the troublesome cough, and in some cases, the hectic fever and morning sweats. Here, again, it is the carbon that does all the good; I have, therefore, been induced to try the inhalation of carbonic acid gas, diluted with the atmospheric air, in proportion to one cubic inch to five; it is not improbable, that one of the causes of consumption may be the want of power to render the non-nitrogenous substances which are taken as food, servicable for respiration. Whether this supposition, hereafter, be found to be correct or not, carbonic acid gas both inhaled and as a bath, is a valuable remedy. Doubtless, all inhaled remedies, applied immediately to the diseased lung and to the blood of the patient, must be more effectual, than when swallowed digested, diluted, and circulated in the blood vessels, &c. Indeed, this latter plan of swallowing medicine, has hitherto proved, and is, I believe, likely to continue most unsatisfactory.

Liebig observes that, " the living body is never, in any state, saturated with carbonic acid; that it is capable of taking up an additional quantity, without any apparent disturbance of the function of the blood globules." Thus, for example, after drinking effervescing wines, beer, or mineral waters, more carbonic acid must necessarily be expired, than at other times. In all cases, where the oxygen of the arterial globules has been partly expended, otherwise, than in the formation of carbonic acid, the amount of this latter gas expired, will correspond exactly with that which has been formed; less, however, will be given out after the use of still wines, than after champagne. The more explicit application of the carbonic acid gas, will be illustrated hereafter by cases.

When gases are introduced into the stomach, they cannot have either so good, nor so injurious, an effect upon the system, as when taken into the lungs, since they must first, like medicine, be mixed with those things met with in the stomach and bowels, such as muriatic and sulphuric acids, which are usually secreted in the upper portion of the tube, as is the hydrosulphuric acid in the lower portion of it; besides alkalis, which the stomach and intestines will now and then secrete, according to a persons' state of health, and, thereby, be partially or totally altered in their character and effect.

When carbonic acid gas is swallowed by drinking champagne, soda-water, seidlitz-water, and in other effervescing drinks, it is always found harmless, and sometimes beneficial. Yet, if inhaled, the carbonic acid gas would suffocate or poison the individual, or bring on the prior condition, a lassitude and a sensation similar to what is experienced by travellers ascending very lofty mountains, because, at a certain altitude, the rarefaction of the air precludes the due supply of vital gas (oxygen): hence, the panting and dyspnœa, and the very frequent acts of respiration, the traveller is obliged to undergo, in consequence of his black or disoxygenated blood, after its passage through the muscles, during walking, not being renewed with oxygen in the lungs, which is consumed in proportion to the degree of their action; therefore, without the vivifying stimulus of oxygen atony of the muscular system, and extreme lassitude necessarily ensues.

The effect of a warm climate upon soldiers and sailors, according to statistical reports prepared for government, in 1840-1, by Dr. Wilson and Major Tullock, appears in the two services somewhat differently, arising, probably, from the difference in their habits and condition. The soldiers are more affected with diseases of the heart, liver, stomach, and intestines, than the sailors; and the latter, are most exempt from hœmoptysis and phthisis, whilst soldiers are less subject to catarrh, pneumonia, and pleuritis. These active complaints of the respiratory organs may be attributed, I conceive, to the continual exposure of the sailor to rain and the spray of the sea, and to his interrupted sleep; to the turning out of his close and heated sleeping place in a state of copious perspiration, to take his turn on the watch on board, during the cold and heavy dews of the night. Another cause is the salt meat, without fresh vegetables, consequently, the muriate of soda, or kitchen salt, abounds in their tissues and blood. The sailors, who accompanied Lord Anson round the world, were so dreadfully afflicted with scurvy that very many died, and of those who returned home, few were free from the effect of their hard fare; most had severe ulcers, either of recent date or old ones reopened, that had been disunited after having been cured for twenty and thirty years; also, fractures that had been united for twenty and thirty years before, became disunited. These facts prove, that new formed parts, eschars, &c.,

are weaker than original parts, and that fresh animal and vegetable food, or a due supply of carbon, will quickly heal ulcers and fractures, for the men all quickly recovered ashore. Charcoal has for a long time been found extremely efficacious in correcting putridity, and in disposing ulcers to heal, in consequence of its tendency to unite with the oxygen of the air. A mixture of oxygen and hydrocarbonate, in proportion of one of the latter and three of the former, four quarts of which was mixed with sixteen of atmospheric air, and inhaled once and twice a day, and gradually increased to five or six quarts, was found by Mr. Barr to be most successful, in a case of an ill conditioned, painful, and large ulcer of the elbow-joint, that had greatly reduced the patient's health. I have had a patient lately sent to me with scrofulous ulcers of the knee-joint. I began the treatment by administering oxygen, one quart to twelve of amospheric air, and continued to do so daily, with the aid of alterative remedies, consisting of bitters and some iodine, which soon had the desired effect of considerably benefitting the general health, and somewhat lessening the irritability and ill conditioned state of the ulcer. She was in town only seven weeks, and returned home quite well.

It will, perhaps, be objected to, the treatment by inhalation, that as internal remedies were administered in all cases I relate, the benefit might, with as much propriety, be ascribed to their operation, as to the inhalation. In answer, I must observe, that an immediate and decided relief to the patient was given by the inhalation of oxygen, and other gases, particularly in cases of oppressed breathing, langour, nervousness, and derangements of the liver, kidneys, and urinary organs,—such as could not be ascribed to any other cause; that various medicines, which had been tried in many cases, by other practitioners, had proved ineffectual; and that, in similar cases, I have wholly failed to produce the same benefit by internal medicines alone. Disease of the lungs is, for the most part, more or less complicated with some error of other organs; and, indeed, the same may be said of the liver, stomach, and kidneys, they soon become morbidly affected by sympathy, and again cured by restoring the normal functions of those organs. Thus it is well known, that the generative organs when only functionally deranged, soon produce in women hysteria and mental depression, whilst disease of the respiratory and the digestive organs soon derange the generative organs; therefore, it would be contrary to good sense to pursue in any case an exclusively local treatment, although I consider local treatment to be essentially important.

The surgeon, who often has immediate access to the seat of disease, justly considers it necessary to join constitutional with local treatment. Not, however, I must here observe, that I consider the influence of the inhalation to be merely local; for example, a patient with affection of the lungs, liver, or of the digestive organs, will express that from the oxygen he finds an improvement of the appetite, and a greater elasticity of mind, or cheerfulness, with gentle perspiration and regularity of the bowels. The soothing effect and relief from constitutional irritation is a most remarkable effect of oxygen. To amend the condition of the functions of a vital organ of such importance as the lungs, and at the same time, the condition of the blood, is indirectly to alter and improve the whole system in the most certain manner. Laennec, when speaking of the treatment of phthisis pulmonalis, thus sums up his observations, and his remark is applicable to the treatment of any other diseased organ—"In order to make a direct attack upon the disease, we ought probably to be able to correct an unknown alteration in the assimulation or nutrition," that is, an alteration in the state of the fluids of the body.

Chlorine has been recommended by many practitioners for the cure of tuberculous consumption, and diseases of the air passages, and in these cases the more distressing symptoms, it is said, were quickly relieved by it. In 1804, the medical qualities of chlorine were accidentally discovered, by the observing that men engaged in bleaching manufactories, who had been subject to complaints of the lungs and air passages, were quickly restored to health, by inhaling the chlorine continually evolved in the process of bleaching. Dr. Cottereau, at Paris, was about the first who gave a trial of chlorine for the cure of consumption, and he constructed an apparatus to apply it to the respiratory passages, and found, he says, much success in its application in practice.

Those practitioners, who regard consumption as incurable, leave their patients to their fate without an effort to save them; although Laennec, Andral, Hope, Murray, Clarke, Carswell, and numerous other modern pathologists, have published examples of the healing of tuberculous ulcers.—M. Baudet states that, in one hundred and ninetyseven autopsies, promiscuously made, he found ten instances in which cicatrization existed in the lungs, without the presence of tubercles, and in eight cases, one or more cavities were discovered in different stages of cicatrization.

Pathological anatomy must be admitted to have clearly shewn, that unassisted nature has effected, now and then, cicatrization of tuberculous ulcers in the lungs; also, that certain remedies, directly applied to them, will cause their healing in the usual manner, by a growth of a fibrous or semi-cartilaginous membrane, or by becoming indurated by a deposit of lymph. Drs. Murray and Scudamore, have published several successful cases of cure by inhalation of iodine; and Dr. Bennet, in his work, entitled "Theatrum Tabedorum," (chap. de Halituum et Suffituum), records many cases of pulmonary disease, cured by inhalations of various gases and watery vapour. From very extensive trials, for some years past, I am fully satisfied that some cases of consumption are remediable, and often cureable, by inhalation of some of the gases, that would inevitably prove fatal by depending upon administering medicines by the stomach, according to the usual system. I am well aware that this assertion will astonish those who have made up their mind, that consumption is incurable, and they will, as they generally do, set down the few practitioners, who believe it, as quacks; nevertheless, the result of practice, and *post mortem* examinations of some scores, convince me that the disease may both be arrested, and cured, by the plan of applying gases, and vapours, to the seat of the disease, in whatever part of the lungs it may be seated.

The benign effect of the inhalation of oxygen, in restoring the normal functions of the digestive and secreting organs, and thereby, sympathetically, the respiratory organs, will be shewn in the following cases:

A lady, aged thirty-one, short and slight, and evidently of a weak constitution, subject to a winter cough, was seized with hœmoptysis some months since; the discharge of blood was not large, and did not continue beyond twenty-four hours. I was consulted in April, and found her affected with very irritable cough, short breathing, a painful state of the chest with oppression, very disturbed sleep, and night perspirations; the urine deposited a lateritious sediment, the expectoration was copious, of a greenish colour, with a faint disagreeable odour. She complained of great debility, the pulse was 92 to 100. The animal heat was 100, and daily, about noon, a hectic paroxysm came on. The following were the indications by the stethoscope and percussion: pectoriloquy at the apex of the right lung, and suspicions at the apex of the left; dull sound generally on the right side, especially at the superior part, also, at the upper part of the left lung. I drew the conclusion, that probably each lung was tuberculous; that tubercles occupied the right, extensively, and that there was ulceration at its apex.

I directed her to live upon dry food as much as possible, and to avoid stimulating drinks, except a glass of ale or porter at dinner and supper.

I commenced the treatment on the 14th, with inhalation of oxygen and atmospheric air in the proportion of seventeen volumes, or quarts, of the latter, and three of oxygen.

16th.—The mixed air produced no evident effect. I administered four quarts of oxygen to seventeen of air, which produced a cheerful sensation and gentle perspiration, and also ordered one of my rubbers to rub the spine and chest for twenty minutes, with tincture of aconite made warm. The pulse was an hundred after these operations, having increased about ten strokes in a minute.

18th.—She was sensible of a very soothing influence from the inhalation, it caused an easy expectoration, relieved the cough most satisfactorily, and rendered the breathing at once comfortable. In four days the pulse was reduced to 86, and the animal heat to 98.

19th, 20th, 21st.—The whole plan of treatment agreed perfectly, the odour of the *sputa* is less unpleasant; the noon paroxysms have ceased and her sleep is better.

27th.—The means have been continued daily, pulse 90, sleeps better, night perspiration less, the shortness of breathing and the troublesome cough are materially mitigated, and the painful sensation about the chest wholly absent—appetite better, her spirits higher, and she feels less fatigue, and dyspnœa on motion, her countenance is evidently more healthy—the urine is clear.

May 25th.—The amendment is still more confirmed, the pulse was reduced to about 78, the animal heat to its natural standard, 97°, the respiration quite comfortable: the cough very slight, the *sputa* small in quantity, and consisting chiefly of frothy mucus, and the nights were passed with good sleep without hectic perspiration.

June 6th.—I have continued the means almost daily from the commencement of the treatment; she now walks a mile or two daily without fatigue, and up stairs without shortness of breath, palpitation and cough as formerly. The paleness of skin has given way to the natural appearance, and her cheeks, lips, and nails have acquired a rosy tinge. She spoke in terms of the highest praise of the inhalation; and, as the patient was very intelligent and minute in her observations, I attached the more importance to her report. She stated, that it invariably gave ease and comfort to her chest, quickly improving the breathing, and relieving the cough.

Asthma, depending upon functional derangements, will generally be removed or alleviated by inhalation of oxygen a few times. I have observed that when patients begin to inhale, they take but very little at each inspiration, however much diluted with atmospheric air; they should, therefore, be directed how to exhaust the air in their lungs, and inspire fully. Some little practice is necessary ere they can fully extend their lungs, and the trouble in doing so, will always be amply repaid by additional health. The countenance becomes clear, with an increase of colour in the cheeks, in consequence of greater proportions of oxygen being absorbed by the blood in the lungs from the atmospheric air. When oxygen is inhaled, mixed with atmospheric air, I invariably observe that the eyes become more animated, and the livid, sallow, or doughy complexion, is soon changed for that of the clearness usually attending health. Two quarts, of oxygen mixed with four hundred quarts of atmospheric air is enough to effect the above changes; indeed, I have of late been induced by the result of my practical observations, to dilute the oxygen in many cases of paralysis with the above proportions of atmospheric air.

The following case of Mr. Danby, written by himself, and published by James Watt, Esq., was the cause of my giving a trial to extreme dilution of oxygen, and which was in the proportion of two quarts to four hundred.

Mr. Danby says: "I was seized with tremors, spasms, and lost the use of my hands and feet; the hands were pendulous, I was obliged to be fed and dressed like a child, quite helpless, having no use of the limbs, being carried from place to place—countenance of black yellow; appetite gone, and nights truly dreadful. A week had not passed from the time of my first inhaling the vital air, before my appetite returned, and my nights were rendered comfortable and refreshing, and my spirits very great—and my countenance considerably altered. Before the month was out, the motion of my hands were so far restored, that I could compose catches and glees, and in six weeks I could use my crutches. I ail nothing now but weakness, the consequence of previous indisposition."

Mr. Danby observed that, "when he inhaled two quarts to four hundred of atmospheric air, he felt a comfortable glow extending to his finger ends, and three quarts of vital air to sixty pints of atmospheric air, caused, after its inhalation, excruciating and wandering pains and a feverish night."

In scrofulous habits and serous temperaments, the modified air is of great benefit in restoring tone and dispersing tumours in the glands of the neck, and affections of the eyes and ears. I have found that in the scrofulous diathesis, and when the mucous, or serous membranes are affected, either in the acute or chronic forms, and particularly the latter, that oxygen, much diluted, acts most benignly in removing the diseased *action*, and restoring the healthy condition of the affected tissues or glands.

In various forms of scrofulous affections in children, such as diseases of the eyes, ears, glands in the neck, and affections of the skin, partial or complete paralysis of limbs or muscles, and general debility without any apparent cause for so much prostration of strength, I have found oxygen, nitrous oxide, or galvanism to effect cures in a vast number of cases after months and years trial of grey powders and the use of iron, in various forms, sea-bathing, &c.; and, in not a few, who had the additional or supposed advantage of foreign spas, had failed even to mitigate the progress of the affections.

Children, afflicted with scrofulous affections, are frequently attacked with disease of the respiratory organs, in consequence of the want of nervous power or energy to fill their lungs sufficiently by breathing, and thus to oxydize their blood, hence the above diseases come on with prostration of strength, and disease of the cartilages or bones of the spine and joints, or a rickety condition of the frame. These cases cannot be cured by medicines alone, for the means of obtaining power are more or less deficient, that is, the power of digesting the food, and of oxydizing the product of the blood, preparatory to its conversion into part of the living frame.

Children, in consequence of prostration of strength, or disease of some organ, are rendered incapable of taking exercise to fill and change the air in their lungs quickly, and thus to oxydize the blood sufficiently. Consequently, I commence with oxygen inhalation, in a certain degree of dilution, according to the age and strength of the patient, and its effect upon the system.

When power is obtained by improving the digestive functions, I then direct remedial means to the local affection. When paralysis of particular muscles of a limb is present, I administer the nitrous oxide gas, or apply galvanism. I have found that when power of the muscular system, &c. is in a certain degree obtained, and the progressive tendency to disease is overcome, that the plan of strengthening, locally or generally, the debilitated muscles, adopted very judiciously and successfully by Mr. Hamon, practitioner of Gymnastic and Hygeinic exercises, and others, is highly advantageous to patients in restoring a healthy tone of the frame, and equalizing the muscular power, and thereby obviating certain forms of deformities.

It would be useless to give cases in illustration of the successful application of oxygen, nitrous oxyde, and galvanism, in the debilitating affections of children, since I have already pointed out the principles on which they should be used; and the following adult cases in the practice of other medical men will prove their success. I prefer refering to others, lest my successful practice should be regarded as an over zealous advocacy of the application of factitious airs, galvanism, electricity, &c., but it is my intention, to give additional cases that I have superintended, which will, I trust, however astounding, carry conviction to the minds of the most sceptical of my professional brethren.

The following cases I have taken from Dr. Beddoes's work on the medicinal use of factitious airs, published in 1795, in order that my readers may not suppose that my confirmed opinion of the inestimable value of oxygen, nitrous oxyde, and other gases, as remedial agents, in certain medical and surgical cases, is not founded upon the best authority, *i. e.* experience suggested and guided by the talent of a Beddoes, Davy, and others, on the continent.

The cases will be selected, not to confirm on another, but to point the appropriate cases for inhalation, &c. I shall content myself by relating the leading facts of the cases, since many of them are unnecessarily minute and occasionally irrelatively described.

J. Patterson, aged 45, (page 64,) patient of Mr. Hill's, communicated by Dr. Thornton, was subject, from the age of fourteen, to eruptions on his face, when Mr. Hill saw him his face was "encrusted over with humours, several purple blotches on his body, many hard scales or scurfs about his arms, and a dark-coloured deep ulcer in his leg, which gave out an ichorus and fœtid discharge. He had also lost his sight nearly eighteen months." These complicated evils had resisted the well-known abilities of Messrs. West, Carr, Turnbull, Wathen, Phipps, and others. This case being recommended by Mr. Phipps to Mr. Hill, he gave him the vital air, (oxygen), blended with atmospheric air, as an alterative of the blood, strengthening his constitution with chamomile tea and bark, and Mr. Phipps continued those applications to the eyes, which, before the purification of the blood proved unsuccessful.

"After a few weeks inhalation of the modified atmosphere, I had the satisfaction of seeing him with a face perfectly clear and smooth, large white scales fell from his hands and arms; the dark purple ulcers on his body, and the vitiated ulcer in his leg were healed, and he had so far recovered his sight, that he had at first a blue, then a brighter light before him; and, after a regular attendance during four months, he was able to discriminate different objects in the street."

Dr. Thornton relates the history of another case in the next page: "The subject of the next case is a widow lady. She had a humour in her right leg which deprived her of exercise, and had produced a painful and discoloured sore in that part, of above eighteen years standing; four years of which time she was attended by Pott, and twenty-seven months by Sharp; but neither of these eminent surgeons were able to effect a cure. After only three weeks inhalation of the vital air, a violent itching came on, and in another week this leg was rendered as sound as the other."

A lady, a mother of five children, consulted me in April 1844, respecting varicose veins of the legs, with great pain in the foot, ankle, and legs, but more particularly of the left leg; her nights were greatly disturbed—she was unable to walk because of the pain that followed; to this circumstance she attributed her difficulty of breathing, cough, head-ache, want of appetite, acrid eructations, continual thirst, and inconvenient stoutness. My patient being of the serous temperament, I attributed her dyspectic symptoms, repletion, and nervousness, to over-indulgence for many years. I commenced the treatment with turpentine draughts, followed by gentle purgatives and tonics, and to the swollen and painful part of the legs, applied the bisulphuret of carbon gas in the usual manner, and on the 15th of April she began inhalation of vital air, diluted with a portion of atmospheric air; and, although her spirits were on that morning exceedingly low, and she was very irritable, and had not eaten any breakfast, and scarcely anything the day before,—immediately after the inhalation she had a pleasurable glow and gentle perspiration, and her spirits became better.

16th.—She informed me that she had enjoyed her dinner with her family at seven o'clock, and slept well during most part of the night, and got down stairs before twelve o'clock, and hoped still to improve. I again renewed the gases as before—the legs were much relieved of their usual pain, and the turgidity was altered for the better.

17th.—Slept well, and the pain in the legs less, and she began to feel a power in them; her spirits were better, and she came down stairs at eleven o'clock and enjoyed a little breakfast.—Ordered the ammoniated tincture of iron in infusion of buchu, and used the gases.

18th.—Informed me she felt, from the time she inhaled yesterday, a pleasurable lightness of spirits until she went to bed, and that she enjoyed her dinner—experienced but little pain in the legs, but slept badly and got down stairs late with lowness of spirits; the medicine was continued, and I administered the gases.

19th.—My patient informs me she feels much better in every respect, less acidity and thirst, and lowness of spirits—the urine is not so frequently passed, and more natural in colour, like sherry. She informed me that it used to be very pale and frequently passed. I noticed also the pulse was fuller than formerly, and the tongue cleaner, the papillæ being more erect and rough, a sure sign of tone. No pain in the legs, and the swelling is decidedly decreased—the remedial means repeated as before.

20th. Continues to do well, having slept well all night, enjoyed her breakfast, and experienced since no acidity, fullness or langour, but on the contrary, a considerable degree of elasticity of mind and body, having breakfasted before ten o'clock, rode out to the park, and walked for an hour before lunch. I found, however, the veins of the legs fuller than they were yesterday, probably from having walked a little too long; she said she had no pain, and her breath was quite altered for the better, as well as the cough, and all the excretions were healthily carried off, without medicine, saving the ammoniated tincture of iron and oxygen inhalations. Formerly the skin was either hot and harsh, or disagreeably clammy from perspiration, it is now soft, without a sensation of exceeding heat or cold.

It is scarcely of any use to pursue the history of the case, inasmuch as the remedies were continued with but slight variation, and it progressed with but few troublesome interruptions, to a most pleasing termination, and she now enjoys good health.

In Dr. Beddoes's work (page 72), the following case, by Dr. Carmichael, is so similar in the symptoms and result of treatment, that were I to describe the symptoms and treatment of some twenty cases I have met with in practice, they would not illustrate more satisfactorily the advantages of oxygen.

" S. P. aged 18, complains of universal langour and debility, palpitation, and difficulty of breathing on the slightest exertion, especially in going up stairs; she is much emaciated, and her skin is universally pale; her feet and ankles, for some months past, have become œdematous towards evening, but more particularly after using exertion. She complains of pains in her stomach, and frequent cough, attended at times with pain of her side; bowels regular, appetite impaired; pulse one hundred and twelve. She has never menstruated, nor had any of the symptoms usually preceeding that evacuation. She first began to complain about two years and a half ago; since which time she has taken different medicines, but without advantage.

Feb. 14th.—I directed her to inhale daily a mixture of oxygen and atmospheric air, in proportions of three volumes to seventeen, this produced no evident effect. I directed six quarts of oxygen diluted with fourteen of common air.

February 23.—This augmentation rendered her nights restless, and she complained of great general heat. Cough more frequent.

26th.—Her evenings are still restless, cough encreased; pain of her stomach not abated; pulse 110 to 125. I directed her to use the modified air, in proportions, at first prescribed.

March 1.—Sleeps better, thinks she is less hot; cough less; pain in stomach not abated.

6th.—Pain of her stomach less—appetite mended; thinks that her spirits are higher than usual; and that she feels less fatigue and dyspnœa on motion; appearance of countenance more healthy, cough less; dyspnœa and palpitation much relieved, sleeps well; œdema of feet and ancles less, except after unusual fatigue.

13th.—Continues to recover, in every respect; cough nearly gone; no return of pain of her stomach for some days; complains of dyspnœa or motion so little, that she can walk a mile, or more, without fatigue.

20th.—Health improved; paleness of skin giving way to the natural appearance; her cheeks, lips, and nails, have acquired a rosy tinge; not yet menstruated, nor are there any signs indicative of such a change; but, as it depends upon a certain tone of the arterial system in general, I have little fear, but that it will be established with the complete restoration of her health, which desirable event, there is every reason to believe, is at no great distance.

CHAPTER VIII.

NITROUS OXYDE GAS.

This gas is decidedly a powerful remedial agent, in restoring muscular energy in paralytic or contracted limbs, loss of voice, and cases of general languor; particularly in hysterical or nervous cases. I have administered, by inhalation, the nitrous oxyde gas, in two cases, to young ladies who were dangerously ill in their infancy, during measles and dentition. The parents were induced to consult me, supposing them to be labouring under affections of the spine: one young lady had a general curvature of the left side, since her illness of dentition, and a proportional cavity on the right side; the left leg was dragged, or partially thrown forward by the muscles of the trunk, inserted into the thigh-bone; but, by the use of a crutch, and the strong muscles of the right side, she progressed, from place to place, with tolerable facility. I found that I could stretch the spine readily into its normal line. I, therefore, determined to galvanize the debilitated muscles daily, and soon after commenced with inhalation of oxygen gas, diluted, and afterwards the nitrous oxyde gas; suffice it to say, that by these means, and rubbing the muscles of the spine and limbs, twice a day, by one of my experienced rubbers, and by directing the mind very frequently to the weak muscles, by raising a weight of shots, enclosed in a stocking on the left foot, and in a glove on the left hand, she recovered the use of her limbs perfectly, and is now able to walk, and even to dance with ease and grace.

The other young lady had lost the use of her left arm, and had squinted ever since she had had the measles, at seven years old; she is now aged fifteen; after having tried the various means suggested by different practitioners without advantage, her parents consulted me in consequence of having read my work on "Deformites of the Spine, Limbs," &c., considering that their daughters' loss of due power of the left arm, and the head leaning to the right shoulder, depended upon the disease of the bone of the neck. I found no reason to think so, I therefore adopted the principles of treatment as in the above case, and in less than a year, the use of the limb and the normal position of the head was restored, and even the squinting of the eye was removed, and her general health was quite restored.

In a case of spasmodic stricture of the urethra, I have used the nitrous oxyde gas with success, also, for the removal of the choaking sensation in hysterical females. The gas is very successfully administered for the removal of muscular twitchings and lowness of spirits.

Although I have used this gas unsucessfully in some cases, I feel perfectly assured that its remedial powers are not yet ascertained, and that it is perfectly harmlessly administered, diluted, or undiluted with common air.

The following commendation of nitrous oxyde gas, abstracted from Sir H. Davy's "Chemical and Philosophical Researches," was my inducement to give it a trial. Sir H. Davy was the first who had the courage to inhale it, and he found, after doing so for three or four times a day, for a week together; at other periods four or five times a week for two months, that his health was good, his mind clear, his digestion perfect, and that the gas excited giddiness, a delightful sense of thrilling in the chest and limbs, acute-ness of hearing, brilliancy of all surrounding objects, and an unconquerable propensity to brisk muscular exertion. These feelings were of short duration, but were generally succeeded by alertness of the body and mind, never by the exhaustion, depression, and nausea, which follow the stage of excitement brought on by spirits or opium.

I have used this gas almost daily without ever having observed ill effects, or a diminution of its virtues. In asthmatic cases, debilitated muscles, langour, loss of tone in hysterical subjects, lowness of spirits, and in cases of torpid secretions with indigestion. In cases of dimness of sight and deafness, I have taken Sir H. Davy's hint with satisfactory results.

A gentleman consulted me respecting deafness, more particularly of the left ear, which followed a severe cold succeeding the measles. He had tried a great many means, usually adopted by aurists, without any benefit. I was induced to try the nitrous oxyde gas; and, under its first influence, he considered it improved his hearing. I recommended him to come to me every day, and I galvanised his ears in the usual way one day and administered the nitrous oxyde gas the following day. Thus, with a little alterative medicine, he was cured in six weeks, and continues well in every respect.

This gentleman having suffered so long, and having a large circle of acquaintances, he recommended several deaf patients to consult me, and I have pursued the same plan in all the cases that I regarded as dependant upon deficient nervous energy, with the utmost satisfaction.

Noises in the head, like murmuring of water, hissing and blowing of wind, rustling of leaves, sounds of bells and other kinds, I regard as nervousness depending upon a diminution or loss of nervous power, arising from the insensible state of the portio mollis of the auditory nerve, or of the surface on which its filaments are spread. Mechanical means are, in such cases, useless, nay, injurious; most of my patients had their Eustachian tube, penetrated by instruments, and air, with injections forced into the internal, as well as the external ear, without any benefit. Indeed, these cases are too intractable to be even relieved by such means. The constitutional treatment of setting the digestive and secreting organs right must first be pursued, and then such remedial means as act more immediately upon the auditory nerves, such as the nitrous oxyde gas and electro-stimulation. These are the means which my experience has proved to be capable of insuring a greater success than any other hitherto tried.

Nervous affections of the eyes are very common, and doubtless perfectly analogous to nervous deafness. In dimness of sight, the cause may be in the defective organs of digestion, or it may even originate in the spinal nerves, or in the branches of the fifth pair, spreading over part of the face. Here the affection may be amaurosis or gutta-serena, in which, though every part of the eye may seem to possess its natural structure, sight is lost, because the rays of light only strike against a paralytic or insensible retina. I can assure the members of my profession, that the function of the optic nerves may be restored by a simple alterative course of medicine, and by inhalation of nitrous oxyde gas, and by electro-stimulation, after all the usual remedial means have been tried unsuccessfully.

I have lately successfully treated some patients who had tried the aconitine, veratria, and delphinia, in various forms, as well as the bisulphuret of carbon, hydrocyanic acid, chloro-cyanic acid, &c. I mention the fact, not with the most distant idea of disparaging their medical virtues, for I regard them as most valuable remedies, and frequently of use in certain painful nervous affections, but only with a view to encourage a trial of different means rather than giving up the cases as incurable, merely from the circumstance of one mode of treatment failing, than from the real nature of the case. The following case was given up by one of the most eminent oculists of the day. In consequence of a successful case under my direction, the patient was induced to consult me, and in less than three months he was perfectly cured by the use of the nitrous oxyde gas, galvanism, alterative medicine, judicious diet and exercise. The patient consulted me for an attack of iritis, with excruciating pain in the forehead, over first one eye, and then over both. He was bled, purged, and salivated, yet in spite of this treatment, the retina became affected, and the sight totally lost for a considerable time. Two oculists were consulted in town, and sight very partially restored, varying in degree according to the state of the weather, and the state of his health. The pain in the forehead also continued more or less intensely and continuously. When I first saw this patient he could only see the waving of a hand or the reflection of a bright object. The vitreous humour was of a greenish colour, and the eye apparently fixed as it were upon vacuity. Both eyes were irritable, his general health was bad, and he felt very desponding. All these symptoms are now, however, a matter of history, and he is able to perform his duties as a clergyman.

It would be useless to relate various cases of deafness, and of blindness, arising from defective nervous energy of the respective nerves of the ear and eye, for in truth, the success attending the means have been most generally singularly gratifying. I feel also perfectly satisfied from ample experience, that, in cases of tic-douloureux, nitrous oxyde gas is capable of removing the affection, after veratria, acontine, and hydrocyanic acid fail, as the following case will show.

A lady, forty-nine years of age, consulted me for tic-douloureux of the right side of the face, which has afflicted her, more or less continuously, for four years, and latterly with scarcely an intermission. Her health was much worse of late, for want of sleep and the power of masticating her food, which whenever she attempted, increased the pain for hours afterwards, extending to the head, tongue, gums, and even the eyes, which were so dim that she could not read the largest print. I first tried the above remedies with but little relief for four or five weeks. I then commenced the nitrous oxyde gas, and galvanism which not only relieved her of her pains, but rendered her capable of masticating her food and enjoying her sleep, and even reading the Times newspaper with facility. All this extraordinary happy change was secured in about three months.

Neuralgic pains of the spinal column and limbs, cramp, ear, and tooth-ache, I have frequently succeeded in curing, after belladonna, aconitine, veratria, &c. which I generally first apply, if not already tried, had failed. I have also found the same remedies requisite in cases of irritability of the heart, asthmatic pain in the left side, which young women are very prone to, and in cases of pain in the bowels, and particularly those severe pains now and then attending the catamenial period; also where mental irritability and despondency are great.

Members, of the higher classes of society, among the luxurious or the sedentary, are frequently susceptible, in a high degree, to excitement, or the reverse: a condition understood by the term nervousness, in which the physical frame is below par, and the secretions of the liver, kidneys, and digestive organs are vitiated, and in females the catamenial period is attended with much pain in the loins, and the secretions are too little or too much, and deficient in color, and are frequently followed by copious leucorrhœa that invariably depresses both the physical and moral powers. In such morbid conditions, the inhalation of diluted oxygen gas is most decidedly the best remedy with which I am acquainted. The facts of its benign influence, I have already abundantly pointed out. But in cases where nervous pains are fixed, or where the nerves of certain organs have lost their functions, as in deafness, blindness, palsy of certain muscles, as those of the face, or of a limb or limbs, I am, from ample experience, more confident of success by the using inhalation of nitrous oxyde gas than oxygen, with or without the aid of galvanism.

A gentleman about fifty-four years of age, short and very lusty, having lived freely, and led a sedentary life, lost his usual health, about eight years ago, following a cold; a cough has continued to trouble him ever since, with a difficulty of breathing; his bowels became irregular, and soon afterwards his heart palpitated, and his cough and difficulty of breathing became much worse. He has now pain across the chest, and the pulsation of the heart is violent and irregular; partial paralysis of the left arm, with pain running down it; his feet are both swollen, his lips are purpled, his eyes dull, countenance sallow, and there is general apathy, except when roused; then he is irritable, and severely reproachful to his friends; his memory is much impaired, his bowels constipated, his urine is ammoniacally offensive, and passed in uncertain quantity, frequency, and ease; he lives entirely upon one floor.

I first directed him to take dry food sparingly, and a draught every four days of castor oil and turpentine, which had the effect of removing scybalæ; I also gave him some bicarbonate of potash in a tonic infusion. I then commenced with inhalation of diluted oxygen gas, which I continued for three weeks, although the patient was much better in his general health at this period; his arm was just as painful and powerless as ever; I then commenced with the nitrous oxyde gas, which removed the pain in the arm in four days, and in less than three weeks the muscular power of the arm was considerably restored. Suffice it to say, that he walks now daily into my house, much thinner, and more active than he was, with but little cough, palpitation of the heart, or difficulty of breathing; his secretions are natural, and his digestion good; his mind, compared to what it was, is active, his appearance is altogether much improved to what it was seven weeks ago, when he first became my patient.

In active gout and rheumatism, my experience will not allow me to recommend either of the gases; but, in the chronic form, accompanied by pain or loss of power, I can most confidently recommend them as the most valuable remedies.

During the inflammatory stages of gout and rheumatism, the alimentary secretions should be gently stimulated in the first instance, and then soothing remedies may be administered internally, and applied externally to the painful parts. Some practitioners commence the treatment of inflammatory gout and rheumatism with colchicum, aloes, and potash, and low diet. In delicate or young patients so afflicted, I doubt the general advantage of such a plan, but in elderly persons drastic purgatives may be more commendable. Low or restricted diet, when the patient has an appetite only adds to the general irritability of the system, and thereby to the local affection.

I have lately attended a gentleman who has been for a week or ten days severely afflicted with acute rheumatism, affecting chiefly the joints of the extremities, which are very hot, swollen and tender to the touch; pulse quick and small, skin hot, tongue foul, urine small in quantity, depositing a large quantity of a dirty white substance. Active measures had already been put into practice, such as bleeding, purging, diaphoretic medicines, and antiphlogistic regimen, with, however, no diminution of the patient's sufferings. I ordered castor oil and potash to be taken twice a day, and on the third day, when the patient's sufferings were but slightly mitigated, I commenced with oxygen gas, which appeared to disagree, on the second day. On the third day, I commenced with the nitrous oxyde gas, with no encouragement, either then or on the second and third day after; therefore, I substituted tincture of aconite and muriate of morphine, both in liniment and as medicine. The patient was quickly relieved of his sufferings, and after ten days, I was induced to try the oxygen gas, but with no advantage, for the patient, although suffering but very little, still remained quite powerless as regards the use of his limbs. I then tried galvanism, and with decided advantage, and after about a week, I recommenced the nitrous oxyde gas, which had the good effect of strengthening the limbs and removing the puffy swellings that had resisted galvanism.

When oxygen and nitrous oxyde gases are tried during the acute form of gout and rheumatism, they ought to be much diluted and administered in very small quantities. In the chronic stages of either affections or in the mixed forms, they may always be used with much benefit to the patient.

In conclusion, I cannot refrain from the pleasure of stating that since the above has been written, further experience enables me to testify that oxygen gas is not only highly beneficial in hypochondriacal and other desponding cases generally comprehended under the head of nervousness, but particularly tic-douloureux and other painful nervous affections of organs and muscles, more particularly when occurring in the serous temperament, or in persons having been exposed to warm, humid, relaxing malarious parts of the country. Persons with naturally debilitated constitutions, or rendered so by atmospheric or local causes, have their blood insufficiently supplied with the red particles of the blood; consequently, after a few gentle aperient doses, and the administration of some preparation of iron and oxygen gas, the constitution is quickly strengthened and the local pains are removed; thus successful remedies in relaxed systems are tonics and stimulants, whilst in the opposite condition of power, they are purgatives and other depleting means, hence a successful remedy in some cases, and temperaments, must prove futile in others, and these principles hold good in the treatment of every other disease.

The want of proper discrimination of temperament, and causes of disease have frequently adventitiously brought, deservedly, into note some remedy, as aconite, croton oil, arsenic, quinine, iron, and other drugs, which afterwards becoming commended as specifics, for tic-douloureux, and other nervous affections, and consequently uniformly used, and thereby proving useless or injurious in many cases ill selected for their administration, sink into unmerited oblivion, but not from want of utility and efficacy in properly selected cases.

These in cases of tic-douloureux, rheumatism, gout, &c., in the serous and nervous temperaments, as well as iron and oxygen, will prove injurious, without the aid of a generous diet; and in the bilious temperament, without calomel, croton oil, aloes, &c., whilst in the sanguineous temperament, neither stimulating food or drastic purgatives are required. In beings over sensitive to moral and physical impressions, from naturally feeble powers, or rendered anæmic, by any cause, more benefit is obtained by gentle laxatives, combined with astringents and stimulants, particularly in persons brought into such condition by ill ventilated warm rooms, anxiety, humidity of climate, and exposure to malaria, &c., which are frequently a source and continued cause of nervous affections, partly inasmuch as they are the cause of dyspepsia of the atonic form. Indeed, in aguish localities, painful nervous affections are common, and particularly follow an attack of ague. It can scarcely be necessary to observe that, due regard must be paid to the functions of the liver, bowels, kidneys, uterus, spinal nerves, and other organs; and if abnormal, we must try, by the usual remedial means, and by directions for amended habits of life, judiciously persevered in, not only to eradicate the disease, but the condition of the frame, or locality of malaria, &c., which may seem primarily to originate or continue the disease.

CHAPTER IX.

ON ELECTRICITY.

The electricity of the atmosphere has of late very properly commanded great attention. The changes which the atmospheric air undergo from the intimate connection that subsists between the electric power and all bodies on the surface of the globe, must necessarily, I think, lead to practical applications in medicine and science, particularly since we know that every chemical action, both in the animal and vegetable system, and in the inorganic world, is accompanied with electric changes.

Dr. Metcalfe, of Pensylvania, has lately written on caloric; its mechanical, chemical, and vital agencies in the phenomena of nature. The work contains views the most original, comprehensive, and scientific, that have appeared upon the subject, either in ancient or modern times. On the obscure subject of electricity, he maintains that it is only a modification of caloric, and demonstrates satisfactorily their mutual convertibility; that caloric is lightning; lightning a concentrated form of caloric, which having converted a large quantity of water into vapour, is given off in an explosive manner, on quick condensation of the vapour, by a mass or current of cold air. Hence, in the tropics, during the rainy season, the first sign of a storm is a light wind, with a few scudding clouds; it begins to lighten, and the sky is immediately obscured by dense clouds, that forthwith descend in torrents of rain. During the intermission of lightning, the sky becomes partially transparent, but of a brassy hue. Dr. Metcalfe adduces many important facts to prove that, transparent or elastic aqueous vapour is the vehicle of electricity, or caloric, and is the proximate source of atmospheric electricity, and not the masses of condensed moisture constituting clouds, as is generally supposed, these being, in fact, the effect of condensation after the passage of electricity-caloric, in the transparent aqueous vapour.

Dr. Metcalfe says that, "in all the operations of nature with which we are best acquainted, *force is always expended in producing motion; and if not as constantly renewed, is very soon exhausted.*" Nor have we the slightest proof, that motion is ever generated without the immediate agency of some active principle. The power of steam is created by the immediate agency of caloric, and ceases whenever the acting principle is withdrawn. The force with which a horse-shoe magnet of soft iron holds on to the armature, is generated by the passage of an electric current through the wires which are coiled around it, but ceases the moment the current is arrested. The metallic wire that connects the extremities of a voltaic battery, attracts iron filings, and deflects a magnetic needle in its vicinity, so long as the electric fluid is disengaged by chemical action, but ceases whenever that action is at an end. The powers of digestion, secretion, nutrition, and muscular motion, are generated by means of an active principle which is obtained from the atmosphere by respiration; but ceases whenever that important function is arrested.

Whatever electricity may hereafter be determined to be, it is certain that we are all made conscious of the changes in the electric condition of the atmosphere during its prevalence, and by its effect upon the constitution, and upon our moral feelings, and some persons are more affected by it than others. Mr. Weeks has ascertained that, according to the electric condition of the atmosphere, the body may become a centre of attraction, or repulsion to all the atmospheric and other particles with which it may be surrounded.

This princple is peculiarly active upon the skin, which may be considered as an expansion of the nerves of sensation; and by acting upon them the whole system may be influenced; this is particularly evident in nervous or delicate people.—Agitation of the air in gouty persons is sufficient to produce pain in the seat of the gout; noise will do the same, and even strong light has been known to irritate the nervous system, although only locally applied to the skin. The following is a most interesting case, which proves to the extreme the theory, without, I think, admitting of any other explanation:

"On the 10th of April, 1777, we got near enough to Sandy Hook, to make a signal for a pilot; and when the gun was fired, although every possible precaution was taken to prevent the effects of the shock on the scorbutic, two of them died instantly."—*Thompson on Scurvy* (p. 81).

Every thing in the animal organism, to which the name of motion can be applied, proceeds from the nervous apparatus, heat and light are the remote cause of motion in vegetables. In animals, the nervous apparatus is a source of power, during every moment of their existence, by its influence upon the digestive, circulating, or secreting organs. Pathology informs us, that the true vegetative life is in no way dependant on the presence of this apparatus; that the process of nutrition proceeds in those parts of the body where the nerves of sensation and voluntary nerves are paralysed, exactly the same as in other parts, where these nerves are in the normal condition ; and, on the other hand, that the most energetic volition is incapable of exerting any influence on the contractions of the heart, on the motion of the intestines, or on the processes of secretion. Yet, mental force, exercises a certain influence on the activity of vegetative life, just as other agents, such as light, heat, electricity, and magnetism do; but, this influence is not of a determinate kind, and manifests itself only as an acceleration, a retardation, or a disturbance of the process of vegetative life. In a manner exactly analogous, the vegetative life reacts on the conscious mental existence.

We may certainly discover the law of vitality, and all that disturb, promote, or alter it, yet, we can never learn what life is, or explain how the rays of light act on consciousness so as to produce vision. Indeed, of those things which are immaterial, the human intellect has only conceptions, because natural science has, probably, or at any rate in the present age has, fixed limits which cannot be passed. Our present business must, therefore, necessarily be confined to effects of electricity or galvanism, as connected with the laws of vitality. The difference between the two consist in the degree of tension, and their modes of excitement. By certain changes which an inorganic body, a metal, undergoes when placed in contact with an acid, a certain something becomes cognizable to our senses, which we call a current of electricity; it manifests itself by certain phenomena of attraction and repulsion which it excites in other bodies, naturally motionless, and by the phenomena of the formation and decomposition of chemical compounds, which occur everywhere, when the resistance is not sufficient to arrest the current. This electric current, formed by the solution of a metal in an acid, when conveyed through a wire, converts the latter into a magnet, by which many different effects may be produced. The cause of magnetic phenomena is an electrical current, and the cause of the latter is ultimately chemical change, chemical action, or in man, the action of oxygen, upon the elements of food, is similar, and the nerves correspond with the wire producing its effects.

Dr. Wilson Phillip has, in his work entitled "An Enquiry into the Nature of Sleep and Death," written thus:—"So completely are the assimilating functions dependant on the nervous influence, that, if the eight pair of nerves be divided in the neck, and one end of the divided ends folded back, in order to prevent any passage of nervous influence between them, the structure of the lungs is, in from fifteen to twenty hours, so deranged, that in many places not even a vestige of their natural structure remains; and so perfectly does voltaic (galvanism), sent through the lungs, as soon as their nerves are divided, perform the functions of this influence, that the structure of the lungs under its operation, is found in all respects as perfect as if their nerves had remained uninjured;" yet, we must not confound galvanism with vital force. Liebig observes, thus—"The nerves, which accomplish the voluntary and involuntary motions in the body, are not the producers, but only the conductors of the vital force; they propagate motion, which in their manifestations are analogous to the vital force, towards a current of electricity; for example, in a precisely analogous manner, they permit the current to traverse them, and present, as conductors of electricity, all the phenomena, which they exhibit as conductors of the vital force." In the present state of our knowledge, few probably, will imagine that electricity is to be considered as the cause of the phenomena of motion in the body: but still, the medical action of electricity, as well as that of a magnet, which, when placed in contact with the body produces a current of electricity, cannot be denied. For to the existing force of motion or of disturbance there is added, in the electrical current, a new cause of motion, and of change in form and structure, which cannot be considered as altogether inefficient.

Where nerves are not found, motion does not occur, and when nerves are divided in their passage to muscles, the latter cease to act, because they are the propagators of the moving force to the production of mechanical effects. The circulation of the blood, and the motion of the other animal fluids proceed from distinct organs which, as in the case of the heart and intestines, do not generate the moving powers in themselves, but receive them by distinct nerves from the nervous centres, the brain and spinal marrow.

The following valuable remarks on medical and atmospherical electricity, with cases, by Mr. E. S. Clarke, are selected from Dr. Graves' most talented work on clinical medicine, which alone may be regarded as a sufficient guarantee for their scientfic and practical importance, and which my ample experience enables me to confirm.

Mr. Clarke, in his communication to Dr. Graves, thus writes:—"I need hardly add, that my private practice, under the guidance of yourself, Sir Philip Crampton, Sir Henry Marsh, Dr. Stokes, Surgeons Cusack, Smyly, Kirby, and other distinguished members of the profession in Ireland, would furnish additional instances in abundance of the very high importance of the various forms of electricity in the treatment of many, otherwise, incurable diseases. In most instances I use the secondary current, developed either by a permanent magnet or an electro-magnet, and sometimes by a very potent thermo-electric arrangement, which I have lately devised. The electric currents are transmitted by directors furnished with moistened sponges instead of steel needles."

The electricity derived from friction of glass, as the aura, sparks, and shocks, Mr. C. finds, he says, serviceable, when other forms have failed; as in some varieties of "catamenial suppression, in some rheumatic cases, and also as a resolvent of schirrous and indolent tumours." The Meath Hospital cases include amaurosis, ptosis, complete paralysis of the right lower extremity, partial paralysis of both lower extremities, complete paralysis of the right arm, lumbar rheumatism, sciatica, neuralgia, femoral and brachial; œdema, catamenial suppression and other irregularities, and spinal irritability. "In fine, I have verified nearly all the efficacy which has hitherto been attributed to this agent, and I have shown its importance as a medical agent to be great, even in the narrow limits as yet assigned to it by the profession."

There can be no doubt that, as a medical agent, higher triumphs await it, since it is identified with nervous influence, and unquestionably able to stimulate organs to perform their respective functions, when torpid, or even when they have altogether ceased to act, as in the paralysis of some extremity, or loss of hearing, taste, or smell. We know that a strong spark along any nerve calls its dependent muscle into action, and in a similar manner along the nerve of a secreting organ, as the liver, stomach, kidney, &c., it excites their functional action. The experiments of Sir Benjamin Brodie, Sir Humphrey Davy, and many others, prove the electro-nervous theory, and it is illustrated in the experiment already related by Dr. W. Philip. Dr. Prout has pointed out that the stomach and liver are in a different electrical condition, and secrete fluids of opposite chemical qualities, alkaline by the liver, and acids by the stomach.

When these and other important organs are impaired in their functions, there can be no doubt that their normal condition may frequently be restored by judicious inhalation of vital air, and the application of electricity of low tension, administered according to the nature of the abnormal functions of the organs affected. The cases superintended by Mr. Clarke and others, as well as by myself, will amply testify to this fact. I introduce cases by other practitioners, lest the great success attending my own practice should be received with hesitation.

I regard the following remarks, by Mr. Clarke, first suggested by Professor Orioli, as important in practice, particularly as they depend on facts which are not generally comprehended or received. The remedying of abnormal secretions of internal organs, by altering the electric state of the secreting organs, which is not "found so difficult as might be supposed, when it shall be understood that it is not necessary that the part whose electric state we desire to alter, should form a part of the electric circuit, but that on the contrary, the electric current is not limited to the space which lies between the poles of the apparatus, but passes beyond it, following the course of the nerves so as to affect parts below and quite exterior to the space supposed to be the passage of the electric current. Thus, if one director be placed on the origin of the sciatic nerve, and the other on the popliteal space, the current will not be confined to the portion of the nerve which lies between the directors, but extend to the plantar extremities."

Mr. C. says, that he has observed: "that of all diseases that electricity removes quickest and most successful, are nervous pains, and next in order come rheumatism and sciatic cases and deafness. After these come some varieties of catemenial suppression. It acts also readily on certain curable forms of amaurosis, then in partial paralysis, and with greater difficulty in hemiplegia than in almost any other form, as this disease requires many weeks of daily, and perhaps, constant application by means of the sustaining battery."

In my work on *Irritation of the Spinal Nerves, &c.* I have related several instances to point out in certain diseases the great success attending the use of electricity. The experience of Mr. Clark perfectly coincides with my own. In order to confirm this, I shall transcribe some of his cases at the Meath Hospital, in Dublin, out of Dr. Graves's work (page 421)—" E. Fitzgerald, labourer, admitted 24th April, 1842, discharged cured, 5th June, aged 50—temperament sanguineous; disease, lumbar rheumatism, extending to the pelvis; also sciatica. Felt much stiffness of the loins and pains when walking, and particularly when attempting to stoop. Had been cupped and blistered, without effect—applied magnetic electricity four times, from 20th to 23rd of May, inclusive, by which time a perfect cure was obtained."

"E. Kelly, labourer, aged 40, admitted 12th May, 1842, discharged, much relieved, on the 28th June—temperament bilious, disease chronic rheumatism, with enlargement anterior and inferior to the malleoli of each foot, accompanied with some effusion into the adjacent parts. Had suffered under this disease during the entire of the past four years, having been treated in other hospitals and discharged uncured; and, since his admission into this hospital, had been blistered, leeched, and treated with hydriodate potash, and colchicum without much benefit. I applied electro-magnetism for about ten successive days, and succeeded in reducing the enlargement below the ankles considerably, and enabling him to walk well; still, after much exercise, a disposition of the same part to swelling existed, and we cannot, therefore say that a perfect cure was effected, even under the combined treatment of medicine and electro-magnetism."

"Anne Cummins, admitted 17th May, 1842, discharged cured on the 1st July—temperament changing from sanguineous to nervous. Disease, ptosis of right eye-lid ; amaurosis, which had deprived right eye of vision, and so injured the left, that she could hardly see the chimney-piece of her ward, when distant from it the length of the room ; also, amenorrhæa of ten months duration, and great general nervousness.

This patient, immediately after her admission, has been blistered over the eyelid on the frontal muscle, and had an issue put into the top of the head, and was subsequently mercurialized, but all without effect. She remained in the same unfortunate state when I saw her on the 17th of June, or one month after the application of blister and issue. I applied magnetic electricity for the relief of the ptosis, for the first time on the 17th June. She had experienced much confusion (as she expressed it) in the head, and had tremulous motion of the left eye-lid previous to the electricity, which symptoms were diminished by its application, and the eye felt stronger. I continued the application of magnetic electricity on the 18th and 20th, by which time the ptosis was nearly cured, and the pupil of the eye was less dilated, whilst its vision was improved.

On the 20th, as well as for a short time on the

18th, I also applied electricity to the region of the uterus, and, on that evening, she menstruated. This action continued on the 21st and 22nd, and the fluid was natural both as to colour and quantity.

22nd and 23rd.—Found her a little feverish, therefore did not apply electricity. 28th and 29th. —Applied electricity this day for relief of the amaurosis, she being in all other respects quite cured. After each operation she felt her head more composed, and sight of the left eye was by this time nearly perfect. After being electrified on the 29th inst., vision returned to the eye, which had been four months blind. 30th.—Applied electricity this day, and found after its application the cure of the amaurosis of the left eye was complete, and at several yards distance she could distinguish the form and colour of small objects with the right eye. This was, certainly, a most successful case, and the triumph of electrical power—ptosis, amaurosis, and amenorrhœa, having all yielded in the short space of fourteen days, after having for thirty days previously baffled the highest medical skill."

"Theodosia Cunningham, late of Chatham-street, admitted the 15th of June, 1842, discharged cured:—temperament, lymphatic and nervous;

disease, total paralysis of the right lower extremity, from the hip downwards; limb so insensible that she might be pinched, cut, or a breast-pin inserted half an inch deep into any part of it without her being conscious of it. The foot was also distorted; the toes and fore-part of the foot pointed inwards, and the external metatarsal portion faced much towards the ground. Also catamenia had been suppressed for thirteen months; but, owing to some mistake, this fact was not communicated to me until the use of electricity to the sacrum and glutœi muscles, in process of cure of the paralysis caused their return. In this case I applied the secondary electric current to the parts affected during five weeks, in which time about twenty-five applications of electricity were made. The success was gradual, but complete. She was discharged on the 2nd July, in full power of her limbs, having danced, I understand, in the ward previous to leaving it."

"Mary Smith, aged 20, feeble, hysterical temperament. Eyes have a peculiar caste, which some very hysterical patients possess. Admitted 12th August, cured 25th August. Disease, catamenial irregularity and scantiness, causing fits of nervous terror and epilepsy. Had no catamenial discharge until her eighteenth year, when they appeared regularly every third week, until she was nineteen years and three months old, but very scanty in amount. For nine months previous to this, or from the period when she was eighteen years and six months old, being now eighteen months ago, she became affected with fits of nervous terror; when nineteen years and three months old, the catamenia became irregular, occurring only every second month, and even then scarcely perceptible; since the catamenia became so irregular and scanty, the fits of nervous terror and epilepsy became more frequent and severe, generally occuring every day, and sometimes three or four times daily; occasionally absent for several days, but always returning with a force stronger in proportion as they were longer absent.

In the milder form these fits consisted in an overpowering feeling of terror, in its stronger form a loss of consciousness and convulsive action; in one of these last fits, she fell into the fire, and her cheeks still bear evidence of the fact.

23rd. August, Yesterday, she had a trifling manifestation of the catamenia, being then six weeks since they last appeared, and as nature, usually in healthy cases continues this action during three successive days, I did not hesitate to apply the electro-magnetic current this day to the region of the uterus in my usual manner.

24th.—Found that yesterday's application, being in the proper time, had the desired effect, and the catamenia were renewed and larger in quantity than she had ever had them.

26th.—Feels light and well, countenance natural, and has had no return of the fits since my first application of electricity to her, although previous to that time she had them each day, since her admission to the hospital.

29th.—Continues well and much improved in appearance."

It will be useless to give more cases in detail either from the works of other practitioners, or from my own notes of cases of paralysis, &c. Since the appearance of my work on irritation of the spinal nerves, a vast addition of cases have presented themselves, and I feel perfectly satisfied that the cause of partial or complete cases of paralysis of the lower extremities, or of the upper, or of any particular organ or muscles in the aggregate of cases, is rather to be attributed to an affection of the peripheral or sentient extremity of the nerve of the paralysed organ or organs, than to the nervous centres, the brain or spinal marrow. If the cause was, as it is but too generally supposed to be, in the brain or spinal cord, or at the origin of the nerves of the paralyzed limbs or organ, the extraordinary success attending the use of galvanism and inhalation of the vital air could not have occurred. It was long since well ascertained, that nerves may be morbidly affected both at their origin and terminations and as they terminate in many branches, and have their origin in two or three roots secured in boney casements, as the head and spinal canal, they must necessarily be more exposed in the former than in the latter case to causes that influence them morbidly. The terminations of nerves are subject continually to mechanical injuries and irritation arising from offensive matter, applied to the skin, lungs, or mucous membranes of all the in-lets and out-lets of the body, and also to the abnormal chemical condition of the blood. Thus we know that paralysis continually occurs in some of the limbs, or some organ, without any pain in the head, spine, or even defalcation in the mental powers or the respiratory, digestive, generative, or excretory functions, and generally without loss of sensation of the paralyzed organ, indeed, loss of sensation is generally caused by disease of the spine coming on more or less gradually. Paralysis, without loss of sensation, frequently comes on suddenly, and when gradual, it is frequently accompanied with twitchings, pricking heats, formication, numbness, or coldness, and the urine is voided frequently, or oftener than natural. Paralysis of a particular nerve or nerves sometimes occur; for instance, a child during dentition will instantly lose the use of an arm, as I have often seen, or become blind; and yet, quickly recover when the tooth is a little advanced, or the swollen gum well divided by a crucial incision, down to the socket. One of my own children lost the use of its left and right arm, at different periods, several times during teething; it is not unfrequent for a nurse to be suspected of letting fall her charge, and thus causing the lost power of the limb. Some little time ago I was consulted by a gentleman who had a fall upon the right shoulder, and he had been treated by his medical attendant for a fracture of the arm, immediately under the deltoid muscle. As he did not recover the use of his arm, although he had no pain in it from the time of the accident, three months before, nor yet during the setting of the bone, as he said, he therefore suspected it was out of joint or something else, and consequently consulted me. I examined the arm and found he had no power to raise it, and the deltoid muscle was cold and much diminished in size as well as the rest of the muscles of the arm. I assured him that he had no dislocation, and that if even a fracture (which doubtless had not occurred) it was quite united, and that, most probably, the nerves of the paralyzed limb would recover their functions by the judicious application of galvanism. I found that sensation over the deltoid muscle was dull. I therefore operated and applied the galvanic action from the commencement of the comparatively insensitive part to its termination, that is a small portion of the upper part of the arm which was readily ascertained by pinching the skin, about the shoulder and the upper part of the arm. This mode of proceeding is of great practical use in partial cases of paralysis, and was first suggested by Mr. Sturgeon. The result in this, and many other cases that I could relate, shows that an activity of a portion of a dormant nerve may be restored without disturbing the quietude of the other portion of it. By attempting to recover the power and sensation of a limb, by operating on the whole of it at once, we frequently fail to do any good, or in arousing sensation and power. Galvanism may be locally applied in the following manner, as directed by Mr. Sturgeon: "Let one of the polar wires be brought into contact with the skin of the shoulder, on the sensitive side." In Mr. S.'s case the sensation was immediately restored, as far as the lower wire, and, consequently, the line of demarcation was so far removed. The first wire was kept permanently on the shoulder, and the other moved slowly downwards; frequent enquiries being made of the patient if he experienced any sensation at the lower point, which was uniformly answered in the affirmative. Thus I proceeded until sensation and power were perfectly restored in my patient.

This plan I have adopted in cases of paralysis of the hips from mechanical injuries, in cases arising from exposure to cold and wet, during hunting, shooting, and fishing. A lady consulted me respecting paralysis of the left side of the face, brought on by exposure to severe cold, during a ride in an open carriage. The case had been very unfortunately treated by bleedings, locally and generally, low diet, purging, &c., under a supposition that the brain was implicated. In two months, by galvanism, together with local warmth and tonics, the muscles were quite restored to their power, and still continue to retain it.

Paralysis, of the upper and lower extremities, frequently occur in persons who either work in wet mines, or at any other occupation that exposes the feet long and frequently to cold water, as sportsmen, and others. The nervous filaments of the cutaneous surface of the limbs conduct the morbid influence of the cold to the spine, and thence reacting on the nerves, produce impairment of the power of motion and diminished sensation. Here we have no irritation in the brain, but abundance of it in the intestines, causing much flatulence in the large intestines, whilst the numbness and coldness commences in the foot, and the affection creeps up the limb, and destroys the power of walking without the aid of a crutch, and the bowels are not acted on without swallowing continually some strong aperient medicines.

Mr. Hunt, of Dartmouth, says: "that he has observed several cases of paralysis of the extremities, in conjunction with, or in consequence of disease of the uterus;" and Mr. Stanley has met with cases wherein the exciting cause was in the urinary system; and Dr. Graves has detailed cases wherein the exciting cause appeared to be inflammation of the bowels supervening on indigestion. Paralysis frequently occurs in house-painters, after an attack of colic, to which they are so very liable; here re-action of the nervous system of the bowels takes place on the muscles, most generally those of the upper extremeties. Dr. Graves relates a case of "a medical student, travelling through Wales, a long journey, on the outside of the mail, during a north-easterly wind which blew in his face. The cold affected the frontal branches of the fifth nerve, and by reflex action, operated on the retina so as to cause blindness. The patient was totally free from all other symptoms, in short, he was quite well with the exception of a considerable degree of blindness. This patient had his sight restored by stimulation of the skin of the face, forehead, temples, &c." Thus we may have the cause of irritation applied in one part of the system, producing morbid action in another; the pathologist will only find the effect of a remote cause which long since has ceased to exist.

Cases of tetanus exemplify this. A prick of a finger or a toe, wounding a small twig of a nerve, will produce an irritation of a nerve which will extend along it to the spinal cord and brain, and is thence, by reflex action, propagated to the lower jaw, muscles of the neck, and finally all over the body, causing horrid convulsions, till death mercifully comes to relieve the sufferer. It is gratifying to know that there are cases on record successfully treated.

In the fourteenth volume of the Lancet, 1828, a case is given wherein electricity and opium were successfully used by Mr. Taylor.

Irritation of the mucous membrane of the digestive tube sometimes extends its influence to the brain, as occurs in children, from worms, when they become blind; or, by reflex progress, to distant parts of the circumference, the irritation affecting generally the voluntary muscles, and producing convulsions. The brain and the spinal cord, in paralytic cases, are not necessarily or primarily affected, but secondarily.

The spinal cord and its nerves, however, may become primarily affected, influencing all the secerning, and particularly the generative organs, from their well-known close connection. When the nervous centres are not primarily affected so as to cause blindness, deafness, and paralysis (that is from sympathy with organs, brought into morbid action by exposure to cold, the presence of a worm in the intestines, or poison, as the absorption of lead), galvanism, or electricity, will restore the nervous function sooner and more effectually than any other stimulant hitherto tried; the electric current should be passed through the cervico-spinal and pneumo-gastric nerves. I have frrequently been informed, by my patients, that they have passed dead worms after I had galvanized them for some other affection. This fact may be somewhat analogous to the well-known effect of a thunder storm upon insects, leeches, worms, fishes, &c., which cause many to die, and all have their vital force, more or less, depressed, before, and during that natural commotion. Anglers well know that a trout will not take a fly or a bait in the condition in which the electric fluid is in during a storm, or whilst it is near. I have no doubt that a gentleman may, in his sitting-room, after little practice, determine by consulting his electrometer, whether he may have sport or not by the river side, instead of wasting his time in seeking the river at a chance of finding the lucky hour. Again, I have not a doubt that sportsmen, in hunting and shooting, have their amusements determined, in a degree, by the condition of the electric fluid which enables their dogs to find, or pursue ill or well, according to the tensity of the electric fluid. Thus, by observing natural laws, sportsmen may avoid disappointments and a consequent disturbance of the equanimity of their minds.

The influence of electricity in cases of poison appears to be extraordinary, as will be seen in the following communication, made to the editor of the Edinburgh Medical Journal, published in March, 1844.

"M. Duclo has instituted a series of experments on rabbits, dogs, and guinea-pigs. He poisoned these animals with strycherine and bricine, and electrified them, and found that, on application of the negative electricity, excited by means of an electrical machine, the symptoms of poisoning subsided, and the animals were saved, the positive electricity, on the contrary increases the muscular contraction produced by the poisons, and hastened death. Animals which had been poisoned with arsenious acid could not only not be saved by electrifying them, but were killed sooner, whether positive or negative electricity was employed."

Dr. Wilson Philips' experiments already noticed, prove, that for a given time, the respiratory and digestive functions may be carried on without inconvenience to the animal economy, without the aid of the nervous system; consequently we may suppose, that when these organs become diseased, it is in consequence of the altered condition of the normal state of the natural electric sources, upon which the organs of digestion and secretion depend, for continued power to perform their important functions; hence the importance of the judicious administration of electricity of low tension, in order to restore a healthful state to these and other dependant organs, as those of sensation and motion; for electricity is the great natural source of vital power, and is probably identical with the nervous influence. In Dr. Graves's work, Mr. Clarke has noticed the experiments of M. Prevost: "showing, that when a sewing needle has been inserted into the crural muscles of a frog, and parallel to the longitudinal direction of the muscular fibres, and, therefore at right angles to the capillary termination of the nerves, distributed to these muscles, it became sufficiently magnetic to attract light particles of the filings of iron, whenever contraction was excited in the muscle by stimulating the cerebro-spinal origin of its motor nerve."

"Thus is made manifest to the sense of vision, the truth of that beautiful theory, which assigns the motor nerves the office of conductors to that electricity, which the brain sends to the muscles as the messengers of its will for the production of all corporeal motion. Hence, we have reason to believe, that the vital electric current, which M. Prevost has shown to accompany motion in the living animal, is really the cause of all human motion, and are led to look with confidence to the use of artficial electricity, as a means of restoring the powers of voluntary motion, to such parts of the human body as have become partially and recently deprived of it, in consequence of paralysis of the motor nerves, arising either from slight structural alteration or deficient power of setting into motion the natural electric fluid at their origin."

Professor Orioli's suggestion may be hereafter put into practice, viz. of remedying all abnormal secretion, by altering the electric state of the secreting organ. Mr. Clarke, at page 435 of Dr. Graves's work, has stated the result of his observations made, "with a view to discover the connexion which exists between atmospheric electricity and other natural agents; such as temperature, barometric pressure, hygrometric condition of the air, both as to free or uncombined moisture, and as to the absolute quantity of aqueous vapour existing therein, in what state soever of dryness it might be ; so as to deduce from the action of one or all of these agents, the natural law, which causes the diurnal changes of atmospheric electricity, and to give a correct statement of the condition of all these atmospheric agents at each hour of the day and night. Atmospheric electricity has one gradual ascent, from three, A. M., which is its minimum, to three, P. M., which is its maximum hour, excepting, however, from this statement, the fact, that there occurs a slight sudden ascent from eight until ten, A. M., and a considerable ascent from five until seven, P. M., as its diurnal maximum."

"The quantity of aqueous vapour in the atmosphere, as indicated by the dew-points, after all necessary corrections are made, has also its minimum at 3, A.M., and its maximum at 3, P.M."

"The thermometric curve exhibits two maxima and minima at the same hours, namely, minimum at 3, A.M., maximum at 3, P.M."

"The thermometric curve exhibits its maxima and minima at the same hours, namely, minimum at three, A.M., maximum at three, P. M."

"The barometer curve exhibits two maxima, and two minima in each twenty-four hours, namely, a diurnal maximum at 10, A. M., and minimum at 4, P.M., and its nocturnal oscillations occur at same hours. These variations, in the height of the mercurial column, amount, according to my observations, to ·020 of an inch, which is an equivalent to an alteration of pressure, amounting to 4.2 ounces on each superficial inch of the human body. This considerable reduction in the amount of the external atmospheric pressure, whilst the internal pressure of the animal fluids remains unchanged, would seem to lead to the conclusion, that the hour of 4, P. M., must be distressing to invalids, but still more so that of 4, A. M., when the reduction of external pressure also exists, and the stimulating sources of electricity and external heat are both at their minima, and the aqueous vapour of the atmosphere is in its most uncombined condition, depositing itself insensibly on the surface of the body, and thus tending to lower its temperature at a moment when the vital forces are least able to resist this action."

Dr. Graves could not have found a more zealous or able person than Mr. Clarke to make the above observations, in order that he might compare the progress of the diurnal changes in atmospheric agents with the periods which he had observed to effect the daily stages of acute diseases. Mr. Clarke writes that, " his meteorological results are deserving of every reliance, having been obtained by a most laborious series of observations, made by him during twelve months, at which time the electricity of the atmosphere was observed, at intervals of fifteen minutes, during, at least, fifteen successive days in each month, and from five to ten nights ; the temperature of the air was observed as frequently : the height of the barometer was noted each half-hour during the same time, and the dew point was taken hourly, with Daniel's hygrometer, during the same period as the other instrument." It is, in a medical view, of great importance to know the law, which in nature regulates the diurnal variations of atmospheric electricity.

Mr. Clarke writes—" We see that the earth (when uninfluenced by the inductive action of passing positive clouds) is negative, and now generally admitted, relative to that of the surrounding atmosphere, in proportion to the quantity of aqueous vapour which has been evaporated from its surface. This ought to make the indications of their relative difference, as exhibited by an electrometer, greater in proportion to the sun's altitude, or rather in proportion to the temperature of the respective hours; and this, I have found to be the case, with the exception of the slight sudden increase of tension, which occurs from 8 until 10 in the morning, and of the sudden but considerable increase which occurs from 5 until 7 in the evening (always speaking of the mean current of each day; as derived from the annual average. This sudden increase of tension, at those hours, arises from the condensation of the aqueous vapour, in the form of dew, which, as before shown, must liberate its previously latent electricity." Mr. Clarke found that these diurnal periods correspond very little with the advance of diurnal temperature in the same place, and that, in regard to this, there cannot be a question of the smallest parellism. If the first minimum of atmospheric electricity manifests itself a little before the rising of the sun, when the temperature of the day is lowest, the second presents itself, on the contrary, from 2 to 4 or 5, P.M., that is to say, in the warmest part of the day; but, if there be but little analogy in this regard, there is so much the more under that of the humidity and visible vapours in the atmosphere. We observe the maximum of the daily period, after the rising and setting of the sun, at hours when the air presents the greatest quantity of vapours, as well to the hygrometer as to our own view."

CASES.

The following cases and remarks on galvanism and electricity, will illustrate their value as remedial agents:—

A case of incontinence of urine, and enuresis, cured by electricity, by M. Froriep, is reported in the "*Lancet*, vol. p. 132, 1844," which I am induced to transcribe, because similar cases are very commonly met with in practice, and very often unsatisfactorily treated by medical men, particularly when the patients are aged. I have been consulted by a great many patients of both sexes, young and old, after deriving no advantage from the usual means adopted in such cases, and in many instances, by some of the most eminent practioners of the day, which I have successfully treated upon the same principles as adopted by M. Froreip, who says—“ Incontinence of urine frequently comes on after severe rheumatic and gouty affections. In many cases these affections have been referred to affections of the spinal marrow; but M. Froreip denies this, as any affection of the lower portion of the cord, which would cause paralysis of the bladder, would at the same time produce some paralytic symptoms in the voluntary muscles, of the lower extremities. He refers it, therefore, to a local affection of the bladder itself, to an affection of the nerves, or for the muscular fibre, or of both. Taking this view of the question, he resolved to try the effect of the local application of electricity. A metallic stilet, terminating in a button-point, is introduced into the bladder, with the aid of a gum catheter, which envelopes the whole but the button-point. The handle of the stilet is then connected with one of the wires of an electro-galvanic battery, while the extremity of the other wire is pressed against the pubes. The electric current is passed through the bladder for a quarter of an hour each day. The bladder in general retains the urine better the very first day after application; but the applica-cation requires to be renewed at intervals, till the bladder recovers its full power. “Several cases are related of this affection, in people from thirty to forty years of age in which the affection was completely removed by the electricity. M. Froriep has found this agent equally powerful in removing the weaknesses on which the enuresis of children depends.

I have lately been applying the electro-galvanic battery for the destruction of calculus in the urinary bladder. I have the wires made to form the termination of a catheter with a septum through its middle of non-conducting substance, with which also the wires are covered, except at the extremities. When the wires are in the bladder they may be pushed forwards, and then they expand sufficiently to take hold of the stone. The operation is simple, and unattended with more pain than is experienced in passing a bougie. The bladder is better prepared for the operation by being emptied of its urine and then injected with warm water. The water is retained in the bladder during the operation, by the wires fitting the apertures in the catheter, and the stone is generally readily seized between the wires, and the electric current allowed to pass by connecting the wires with the battery, and continued for a few minutes, and repeated as often as circumstances may permit. This operation is not only safe, but bloodless, painless, and effective, as far as I have had an opportunity of trying it in cases of concretion of phosphate of lime and lithic acid, in both the patients have been relieved of all their former distressing symptoms, and in neither can a stone now be detected. Through the aid of some medical friends attached to some infirmaries, I am promised other cases to operate upon, and I shall publish the result.

I prefer giving the following cases of other practitioners, lest my own successful management of galvanism, oxygen, &c., should be received with any thing like doubt by my professional brethren.

Mr. Corfe, of the Middlesex Hospital, has related in the "*Lancet,*" Jan. 27, 1844, the good effects of electricity upon a man who had taken an ounce-and-a-half of laudanum on the preceeding evening, six hours previously. "In the first instance I ordered the administration of the stomach-pump, at which period, to all appearances, he was a lifeless corpse; the pupils were contracted to a pin-hole in size; the pulse was intermitting, and not more than 40; the respirations convulsively performed, at intervals of half-a-minute; the face livid, and the extremities bluish and cold. After the stomach had been relieved of its contents, green tea, with ammonia, was injected therein; flagellation with thin splints, and wet towels, the cold douche, turpentine stupes, and sinapisms to his calves and abdomen, were applied in succession, without the least improvement in his condition. The bladder was relieved of six or eight ounces of light-colored urine, by the catheter. I then thought of a most powerful remedy, which was attended with extraordinary success. I allude to the electro-magnetic battery, conjointly with electricity, which was set to work upon him soon after four o'clock. The pulse became more steady, firm, and frequent; the respiration more indicative of resuscitation. Our powerful electrical machine was got into full play before a large fire, and the jar filled, when some brilliant sparks and strong shocks were occasionally passed through the head, spine, chest, and abdomen."

In chronic bronchial affections and asthma, I have found a few moderate galvanic discharges, well directed, obliquely through the chest, from the neck on one side to below the ribs on the other, to diffuse their influence through the principal organs of life. By these means the respiratory organs are excited to perform their natural functions, and the heart is also excited into more energetic action, and thus the patient is relieved and strengthened by the blood being better oxydized, and the food being better digested. By the same means, and upon the same principles, paralytic, gouty, dyspeptic and rheumatic patients are greatly relieved, and often quite cured; and the beneficial results of the electro-physiological treatment, in the hand of various practitioners, can now leave little doubt respecting its influence, particularly since galvanism has been successfully substituted in performing the nervous functions; its action, therefore, as an auxiliary, to the nervous energy, when the latter was too debilitated to act efficiently alone, was naturally sought for to remove the consequent atony of the organs or to stimulate the nerves into functional action. Thus we can restore the action of lost muscles and atonic organs,—aid other modes of treatment by rousing the debilitated powers, with greater promptitude and energy, than by any other known plan.

The eighth pair of nerves, which have such an immense command over the functions of the respiratory and digestive organs, and biliary system, are necessarily, important objects for pathological research, relative to the influence of galvanism upon them. It is probable that any defect in the performance of the functions of the respiratory and digestive organs, might, in many cases, be supplied by an electric current traversing the eighth pair, from the neck downwards, to opposite the diseased organ, better than by any other route; but, affection of the liver, arising from congestion, will be more relieved by transmitting the current directly through the organ from one side to the other, whilst, any obstruction to secretion from atony of the organ is benefited by a feeble current, or a series of feeble galvanic discharges in the direction of the eighth pair from the neck to the liver. I have received, under my care, several patients, with bilious and constipated habits together with asthma, rheumatism, spasms, rigid muscles, local nervous pains, and indurated tumours, and who were either greatly relieved or cured by the use of galvanism. That eminent physiologist, Dr. Wilson Philip, says:—" I have employed galvanism in many cases of habitual asthma, and almost uniformly with relief. The time during which the galvanism was applied before the patient said his breathing was easy, has varied, from five minutes to a quarter of an hour. The cough, under its use, generally becomes less frequent in proportion as the accumulation of phlegm in the lungs is prevented. It is remarkable, that, in several who had laboured under asthmatical breathing for ten or twenty years, it gave relief, quite as readily as in more recent cases. In some, labouring under the most chronic forms of phthisis, in whom the symptoms had lasted several years, the relief obtained from galvanism was very great, notwithstanding the mixture of some pus-like substance in what was expectorated. The permanency of the good effects of galvanism in the diseases before us, has appeared very remarkable." Respecting affection of the liver, the Doctor thus writes :—"where there was a failure in the secreting power of the liver, or a defective action of the gall tubes, I have repeatedly seen from it the same effect on the biliary system which arises from calomel; a copious bilious discharge from the bowels, coming on a few hours after the employment of galvanism."

I have lately attended a young lady for amaurosis. I applied galvanism to the supra and infra orbital branches of the fifth pair of nerves, as well as from the nape of the neck to the stomach and limbs. After proceeding thus daily for six days, the bowels became relaxed, and much bile and mucus were passed together with numerous dead worms; from this date her sight rapidly recovered, and she is now quite restored. Although I was not aware that my young patient was troubled with worms when I applied galvanism, I can have no doubt that the worms caused intestinal irritation and the blindness. My patient had consulted two oculists, who had, like myself, overlooked the real cause, and both adopted a somewhat similar plan of treatment with the same unsuccessful result.

It is well known that intestinal irritation often causes both acute and chronic inflammation of some parts of the eyes, and also of the ears. Such sympathetic affections cannot be relieved or cured, without removing the cause in the digestive organs. All organs are sympathetically excited to morbid action, through the influence of the cerebral and spinal nerves, which by reflex action, may affect the organs of the senses.

Electricity and galvanism are but different names for the same agent, the matter being in a different state of tension or elasticity, and much greater in electricity than in galvanism.

The public are generally mistaken with respect to the electric shock, supposing it to contain the remedial principle of electricity. Now the shock depends on the electro-momentum, and, therefore, the sensation only is the effect of a sudden mechanical blow given to the system by the transit of the electric fluid through the person who experiences it; were the shock the only effect produced by an electric discharge through the animal system, it would scarcely be admitted into the list of physiological phenomena or of remedial agents. In applying electricity to the body, no violent shocks should be administered, they never do good, and may be productive of evil. Pains in the limbs, or rheumatism, frequently require more formidable electric shocks for their removal, though in most cases powerful sparks have a better effect. In applying electricity to the ear, I am convinced that shocks in no instance should be administered from a jar to any part of the head, for fear of injuring the brain. In affections of the ears and eyes, the aura answers sometimes better than sparks; both forms of application are somewhat tedious, now and then requiring a daily application for several weeks, yet, occasionally, success attends with three days application, but it mostly requires four or five weeks.

It must not be supposed that elecricity is incapable of doing serious injury when used indiscriminately to every part of the body, by non-medical or unskilful practitioners. The perforation of paper or a thick card, by the electric fluid, will indicate to the physician the probability of injuring delicate tissues or blood vessels of the body, indeed we are not without instances of such injuries having been committed, in short it is an agent of good or harm, according as it is judiciously or injudiciously administered.

Fortunately, the injuries bear so small a proportion to the sanatory effects, that advantage has been taken of electricity and galvanic agency for the removal or abatement of almost every variety of disease, by men who have not received a medical education, and, in some cases, with a degree of success which has not attended any other medical agents.

Dr. G. Bird has published, " in Guy's Hospital Reports," several cases of cholera, paralysis, rheumatism, amenorrhœa, which were successfully treated by electricity and galvanism. We have ample records that these agents will relieve visceral constipation, promote normal glandular secretions, allay local chronic inflammation, remove deafness, head-ache, lowness of spirits, and excite activity in the vital functions; hence, its successful application in paralysis, loss of sight, depending upon want of nervous tone of the optic nerve, and in cases of asthma, affections of the liver, stomach, kidneys, bladder, and generative organs. The mode of applying electricity, I have pointed out in my late work "On Irritation of the Spinal Nerves" as the source of the principal diseases of the body," to which I beg to refer the reader.

THE END

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TESTIMONY OF THE PRESS,

Extracted from some of the numerous commendations on DR. RIADORE'S *work entitled "Irritation of the Spinal Nerves," &c. &c.*—J. CHURCHILL, *Princes Street, Soho. Price 5s.*

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"Dr. EVANS RIADORE'S work is the result of practical observations made during a quarter of a century. He observes that 'whilst the healthy functions of every organ in the body must depend upon its nerves, and since there are but two nerves that arise in the brain, descending below the neck, and fifty-eight from the spine to supply all the organs of the trunk, it must needs be, that the source of disease is more commonly found in the spinal nerves, than, as it is generally supposed to be, in the stomach, liver, or brain.' Hence spinal irritation is a secret cause of many painful and lingering diseases, which the Doctor has explained the mode of detecting and successfully treating its various consequent maladies. To our medical and non-medical readers we recommend the work as a magazine of facts, original thinking, and sound practical opinions of much value."—*Morning Post.*

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